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INDO-PACIFIC FISHERIES COUNCIL

FOOD AND AGRICULTURE ORGANIZATION
OF THE UNITED NATIONS

BANGKOK

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FRESHWATER FISH CULTURE TRIAL, BRUNEI STATE *

by

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The unsteady supply of salt water fish in the Brunei State led to the trial of freshwater fish culture. The raising of carp was started in 1954 when the Department of Agriculture imported 300 fry Chow Hu (Grass Carp) from Singapore. These fish originated from China. Another importation of 588 fry was made in 1955 & 1956 but great mortality was encountered in transporting them to Brunei. Out of the 588 fry imported only 9 reached maturity. The keeping of carp continued and in 1958 the Department of Agriculture again imported five species of Chinese carp from dealers in Singapore. The object of this third importation was to determine what species of Chinese carp is best adapted to Brunei conditions. One of the causes why Chinese carp do not breed in tropical countries is perhaps because the water is not suitable. In particular, peaty water seems to inhibit

breeding and most of the streams in Brunei come from black peaty soils.

These five species of carp fry were put together in the concrete pond at Kilanas as it was thought that they were too small to be put into the big excavated pond. There were 1,100 fry made up of the following species. 600 Twa Taw Song (*Aristichthys nobilis*), 200 Chow Hu (*Ctenopharyngodon idellus*), 100 Peh Lian (*Hypophthalmichthys molitrix*), 100 Leng Chee (*Cirrhina molitorella*) and 100 Lee Koh (*Cyprinus carpio*). After a week they had to be moved to the excavated pond because overcrowding had caused a high mortality rate. There were no more deaths after they were transferred in the excavated pond. At the end of the first year 128 Twa Taw Song, 66 Chow Hu, 16 Peh Lian, 69 Leng Chee and only 4 Lee Koh were counted to be living in the pond. The results of the first and second year are shown as follows:—

	1958	
	Average Length	Weight
	cm.	
Chow Hu	37	707 g.
Twa Taw Song	25	623 g.
Lee Koh	23	170 g.
Leng Chee	18	170 g.

	1959	
	Length	Weight
	cm.	
	50	1588 g.
	41	964 g.
	24	170 g.
	(no measurement)	

The mortality amongst fry in the concrete tank was certainly not due to overcrowding as this tank was almost the size of the ponds recommended for this number of fry. It is much more likely

that the cause of death was asphyxiation. Water in a concrete tank is not likely to renew its oxygen content at a sufficient rate to maintain this large number of fry and from the description of the dead

* Paper presented as Technical Paper 16 at the 9th Session of the Indo-Pacific Fisheries Council, 6-23/January 1961.

fry lack of oxygen appears to have been the probable cause. Changes in temperature are also another likely cause of death. The concrete tank is entirely above ground and there was probably considerable variation in temperature although no attempt was made to check water temperature. Again concrete tanks are not normally used for keeping the fry of Chinese carp and there are undoubtedly good reasons for this.

The growth of the fish when transferred to the big pond is so poor as to be incredible. Chow Hu and Twa Taw Song under proper conditions reached a weight of at least 1.8 Kg. in a year. Here they

have not reached this weight after two years. This slow growth is due to a number of factors. In the first place if this fish to grow properly different varieties must be put into the pond in the right proportion. Experience has shown that there should be 50% Chow Hu, 20% Twa Taw Song, 10% each of the other kinds. In this case there was only 23% Chow Hu put into the pond, enough in itself to cause a slow weight increase in the other varieties. Again the excavated pond was too small for the number of fish put into it. This number of fish requires 4.64 m² of pond.

THE TROPICAL FISH CULTURE RESEARCH INSTITUTE,* MALACCA, FEDERATION OF MALAYA

By

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The Tropical Fish Culture Research Institute at Malacca arose out of a pressing need for full-time research into the problems connected with the culture of fish in ponds, research unhampered by the demands of departmental administration or by the demands of teaching in a University. Accordingly, a modern, scientifically planned Institute was built at a cost of some £ 235,00 (US\$ 65,800) to the Colonial Development and Welfare Funds, and it has been largely maintained from these same funds. It is intended to serve, in the first instance, all tropical Commonwealth territories, although because of its situation, special attention will be given to problems of fish culture in the Federation of Malaya.

The Institute was officially opened on 21st August 1957, ten days before Malaya achieved independence, but the Director, Dr. Prowse, and a former member of staff, Dr. Fish, had been working at the site of the Institute for some time before that date. To overcome administrative difficulties arising from the fact that Colonial Development and Welfare Funds are no longer held in an independent Malaya, an agreement was signed on 7 June 1960 between the government of the United Kingdom and that of the Federation of Malaya to set up a Board of Management for the Institute. In the agreement provision is made for the admission of other contributory governments or bodies by joint decision of the

*Paper Presented as Technical Paper 35 at the 9th Session of the IPFC, 6-23 Jan. 1961.

two signatory governments. Legislation to incorporate it has yet to be passed in the Federation of Malaya, before the Board can operate.

Besides being the largest station of its kind in S.E. Asia, and one of the largest in the world, the Institute has certain special features not easily available elsewhere, thus enabling fields of research to be studied which cannot adequately be covered in other research institute. The laboratories and office buildings are of modern design, well-equipped and with six working rooms offering research facilities for eight scientists, including visitors. The full complement of resident scientists will be six, of which only three, including the Director, are at present working at the Institute. It is anticipated that by the end of 1961 all posts will be filled and that all six scientists will be in residence. Included in plans for the next three years are proposals for extensions to the present facilities, aimed at accommodating three visiting scientists and ten post-graduate research students. Residential accommodation for them is also included in the plans. Together with the laboratories are thirty eight concrete tanks, fed by rainwater from a tower, and eight similar tanks which can be subjected to variable light treatments, including artificial variation of "day length".

The pond area consists of some 70 hectares of former swamp land, of which 33 hectares are now actual water surface. There are 164 ponds ranging in size from small 40 m² breeding ponds to large ponds of 1.82 hectares. Included amongst these is a "Latin Square" consisting of 36 ponds, each 0.4 hectares in size. This arrangement enables trials of fertiliser treatments to be carried out statistically. In addition the planned grouping of other

ponds of uniform size and shape allows a variety of statistical experiments. It is the design of this whole experimental area which makes the Institute so different from others.

Research

Although the various aspects of extension work are naturally of interest to the Institute, its aim is primarily concerned with research into the fundamental scientific principles behind fish culture. Nevertheless practical and economic implications are borne in mind when designing experiments. In short the main aim of the Institute may be described as trying to discover how good crops of first quality fish may be raised quickly, cheaply and with the minimum expenditure, and equally important the scientific reasons for successes and failures. The problem of improving production may be attacked in two ways—improving the fish themselves, both physiologically and genetically, and improving the supply of food to fish. Both these aspects are under intensive study at the Institute.

Stocks of twelve species of fish are maintained at the Institute, but by reasons of the limited scientific staff only Grass carp (*Ctenopharyngodon idellus*) and the various strains of *Tilapia mossambica* are subjected to intensive research, although some work has already been carried out on *Puntius javanicus*, *Catla catla*, *Tilapia zillii* and *Tilapia melanopleura*.

As is well known, grass carp have not been known to breed in tropical ponds and all fry have to be imported from China, with consequent losses en route. At the Institute attempts were made to induce the maturation of the gonads and actual spawning using injections of pituitary extracts or tranquilizers, but without any success. From a critical exami-

nation of the many papers published on this topic, it now seems probable that some at least of the conclusions drawn in the past were based on faulty experimentation. On the other hand at the Institute evidence has been accumulated that maturation of the gonads depends on adequate acclimatization of the fish to the pond environment. This has been achieved, at least partially, by good feeding and lack of disturbance, whilst subjection of the fish to flowing water, even for only a few hours each day, has brought about complete maturation of the ovaries. To effect this flow it has been necessary to convert a half acre pond, using the 1.82 hectare ponds as reservoirs supplying the waterflow. Under these conditions the grass carp, and later *Catla catla* reacted remarkably, shoaling and swimming up the current in a manner not previously observed in fish ponds. The stimulus required to bring about actual spawning appears to be a much more sudden and vigorous one. In nature this is the rapid flooding of the river in the rainy season. At the Institute spawning was achieved in at least one fish by flooding the pond, opening the sluices of all four large reservoirs. Unfortunately one of the latter contained highly acid water, and when this reached the fish they succumbed before they could be rescued. Later attempts with fresh stocks of fish suggest that after peak of the spawning season has passed the stimulus required to induce spawning needs to be of much longer duration, and this was not possible with the arrangement being used. It is hoped to overcome this limitation, both by adaptations in the ponds, and by setting up a substation in the mountains where water supply is not a limiting factor.

The story of our research on *Tilapia mossambica* is becoming well-known.

The "Malayan" strain is derived from Singapore stock, hence also Thailand, India, Ceylon, Hongkong, Borneo, New Guinea, the Philippines and Hawaii derived their supplies. In common with many other related species *Tilapia mossambica* has the disadvantage that it breeds too freely under pond conditions, quickly becoming overcrowded. Successful crops depend on the use of mono-sex cultures. The Institute at Malacca imported a closely allied strain from Zanzibar and these fish were crossed with the Malayan strain. It quickly became obvious that the hybrids were vastly superior to the parents, heterosis being so marked that the hybrids grow twice as fast as their parents. More important still, when a Zanzibar male is crossed with Malayan female all the hybrids appear to be male, and thus a mono-sex brood is produced without the problem of sexing the fry. Our geneticist, Mr. Selvarajah, is trying to unravel the reasons for this skew sex ratio, and at the same time by selection improve the parent stocks. Attempts are also being made to cross the two grass-eaters, *Tilapia zillii* and *Tilapia mossambica*.

Large stocks of *Puntius javanicus* are kept at the Research Institute for experiments with fertilisers and for other experiments. By chance 4 pairs of fish put in a 0.1 hectare pond spawned, if not all on the same day at least within a few days. Some 150,000 fry were produced and these were fed regularly with a little rice bran. Under the conditions of intense competition it soon became obvious that there were marked differences in growth rate, so much so that at present it is possible to pick out three different size groups with apparently no overlap. With this natural "selection pressure" operating it will be possible to artificially

select the most vigorous to improve the stock.

In addition a number of important scientific problems are raised, since little is known about populations under very adverse conditions. It also throws doubt on those various experiments on frequency of spawning, where the groups have been arbitrarily determined on the basis of size.

On the problem of suitable fertilizers the Latin Square system has come into play. Using this it has become obvious that, under Malayan conditions at least, phosphate is by far the most important fertilizer, provided the ponds are limed to neutrality. Potash and nitrate appear to be without effect, either alone or combined with phosphate. More important, an application of 45.4 kg. superphosphate will produce an average crop of 670 kg./hectare in 6 months as against 291 kg./hectare with several tons of animal manure. These figures are experiments with no supplementary feeding, the ponds being stocked with 600 hybrid *Tilapia*, 10 grass carp, and 40 *Puntius javanicus*. Indications are that the ponds were heavily understocked for the grass-eaters, and that with phosphate alone they should be capable of producing 1,120 kg./hectare in six months. The superiority of phosphate over animal manures raises serious doubts about the economy of the traditional methods of fish culture, but this is the subject of a separate paper.

A much neglected problem is the question of a suitable size for a pond. It is believed that fish grow larger in ponds of greater surface area, even when stocked at the same rate per area. By dividing a longish one acre pond into 1/3 and 2/3 with wire netting, and stocking twice as many fish in the larger area we have

found that grass carp grew significantly larger in the larger area. It seems possible that this may also be true of *Tilapia*, but in the first experiment the results may have been complicated by the heavy stocking rate 2,220/hectare. The experiment is now being repeated with four similar ponds and stocking rates from 740 to 2220/hectare. The merit of this experiment is its simplicity, since all the fish in the same pond are subjected to the same water conditions.

Studies of the food-chains and digestive system of plankton feeding fish has been very revealing. Using both laboratory cultures and natural plankton it has been possible to work out which organisms are most easily digested and which are not. Furthermore, by means of pure culture experiments it has been possible to determine which are the essential ions for the growth of the beneficial plankton, and which should be added to the natural river water (which is the water used in the ponds). Results so far indicate that by far the most important ion is phosphate, with magnesium also important, but potassium and nitrate have little effect. This confirms the results obtained in the experimental ponds, where magnesium is already added with the limestone used to neutralise the water. The study of food-chains and digestibility also tends to bear out the superiority of phosphate as a fertilizer over animal manures, since in the latter non-digestible algal forms are abundant.

There are many other research aspects being investigated at the institute, but some of these, such as taxonomy, etc are less directly connected with the practical side of fish farming. Suffice to say that in a short space of three years the Institute has proved itself.

GENERAL TRENDS

World Fishery Production

The upward trend of the production continued in 1960. According to preliminary estimated the world catch rose to about 37.5 million tons, or some 6 percent more than in 1959 (Table II-3 and Annex Table 11).

A large part of the expansion in the world catch was again in Peru, where was an increase of more than three-quarters to over 3.5 million tons in 1960. This figure was exceeded only in Japan and Mainland China, so that Peru, whose catch was less than half a million tons as recently as 1957, is now the third largest fish producer in the world. The rapid increase in production is reported to have continued in the U.S.S.R. and in Japan, where fish production is estimated to have reached 6 million tons in 1960 for the first time.

In a number of important fisheries of western Europe and North America, on the other hand, catches were smaller in 1960. In western Europe this was primarily because of reduced abundance of fish in traditional fishing areas in the North Sea and the waters off the United Kingdom and Iceland. The herring fishery, in particular, was a failure in 1960. Western Germany's deep sea and coastal herring fishery yielded about 30 percent less than in 1959. Decreased landings in Iceland, Norway and the United Kingdom were also primarily because of a reduction in the herring catch, but other species too were less abundant than the year before, including cod in Norway and redfish in Iceland.

In both the United States and Canada, landings were lower than in 1959, though the reduction in the United States was slight compared with the fall of almost 15 percent in Canada. Catches used exclusively for fish meal production were

lower on the Atlantic and Pacific coasts of North America, chiefly because of marketing difficulties for fish meal. The Californian tuna fishery recovered, however, reflecting the gradual change over from long-lining to purse-seining. The United States shrimp fisheries did well in the principal producing region of the South Atlantic and Gulf area, but there was a decline in northwest Pacific waters. In Canada's Atlantic coast fisheries, larger landings of lobster, redfish and herring more than offset the lower landings in the cod and haddock fisheries. On the Pacific coast, however, catches dropped by almost 50 percent, as a result of the lowest salmon landings on record and reduced herring production.

While in western Europe and North America the proportion of catches used for human consumption was somewhat higher in 1960 than in 1959, the outstanding feature of the increase in world production was again the spectacular advance in fish meal production in Peru. With a rise in production from 332,000 tons in 1959 to 570,000 tons in 1960, Peru became the world's largest producer of fish meal. Among other major producers, only South Africa, Japan, Spain, and Chile increased production in 1960, and a number of countries curtailed their output of fish meal in view of the sharp drop in prices.

Salted cod production, which had been on the decline for the past three years, increased in 1960. The production of salted herrings was lower, however, in Norway and Western Germany because of the poor results in the herring fisheries. Canning operations were affected to some extent by the lower production in the salmon fisheries off the northwest coast of America, as well as in the European herring fisheries.

TABLE II - 3

Estimated world catch of fish, crustaceans, and mollusks

	1938	Average 1948-52	1953	1954	1955	1956	1957	1958	1959	1960 (Prelim.)
	 Million metric tons, live weight									
Western Europe .	5.44	6.19	6.77	7.24	7.35	7.77	7.33	7.18	7.5	7.3
Eastern Europe and U.S.S.R. .	1.70	1.99	2.28	2.58	2.84	2.99	2.94	3.04	3.2	3.2
North America .	3.15	3.60	3.62	3.83	3.78	4.12	3.79	3.75	4.0	4.0
Oceania	0.09	0.09	0.11	0.11	0.11	0.12	0.13	0.13	0.1	0.1
Latin America .	0.24	0.50	0.73	0.80	0.97	1.08	1.33	1.83	3.0	4.5
Far East	9.10	7.42	9.78	10.46	11.29	11.62	13.06	13.93	15.5	16.0
Near East	0.33	0.38	0.43	0.43	0.41	0.44	0.43	0.43	0.4	0.4
Africa	0.45	1.03	1.52	1.56	1.60	1.71	1.82	1.81	1.9	2.0
World total	20.50	21.20	25.24	27.01	28.35	29.85	30.83	32.10	35.6	37.5

(State of Food and Agriculture, FAO, 1961.)

Oceanic Research

One of the two National Committees set up in India by the Ministry of Scientific Research and Cultural Affairs is the National Committee for Oceanic Research. Its functions will be: to draw up a coordinated plan for India's participation in the International Indian Ocean Expedition; to advise on allocation of the program between departments of government, research organizations, and university laboratories; to consider and approve a detailed plan for research in the several scientific disciplines related to India's participation and to recommend financial grants; to promote and coordinate the research programs; and to advise the government generally on all matters connected with India's participation in the expedition. This committee will also function as the National Committee for all oceanographic work. (*Comm. Fish. Rev.*, June 1961)

Navigation of Salmon

Early sea captains and desert wanderers may have been the first humans to discover celestial navigation, but apparently the fish beat them to it. Evidence has been found by scientists of the Fisheries Research Board of Canada at its Biological Station at Nanaimo, B.C., Canada. Observations on adult salmon have produced evidence that migration is limited to particular pathways at particular times, and the influences of daily, lunar, and seasonal cycles in activity or behavior, of weather changes, and of hydrodynamic forces have been substantiated. Experimental studies on orientation in sockeye smolts has indicated consistent directional tendencies when visions of only the sky is permitted; overcast skies or artificial covering has resulted in the fish pointing in random directions. Moonlight, sunset after-glow, or even city lights may interfere to some

extent, but the studies indicate that celestial orientation is an essential component for the successful migration of the sockeye out of lakes and towards the sea. (*Trade News*, Jan. 1961)

King Salmon Eggs

Chinook or king salmon originating from the State of Washington, U.S.A. are swimming in Japanese streams when the product of 100,000 chinook salmon eggs sent to Japan in November 1960 by that State were released from salmon hatcheries in Japan. The experimental shipment of eggs showed a high degree of success in survivals. The eggs arrived by air freight in perfect condition, with virtually no mortalities. The eggs were hatched in three salmon hatcheries and the young have now attained the feeding stage with only a 2% loss. The chinook eggs were distributed as follows: Chitose salmon hatchery, Hokkaido, 50,000; Tsugaruishi salmon hatchery, Iwate Prefecture, 25,000, and Otsuchi salmon hatchery, Iwate Prefecture, 25,000. The shipment of 100,000 eggs was the second lot the Washington Fisheries Department has sent to Japan to aid that country in efforts to create runs of chinook salmon. The first lot was sent in 1959. (*Comm. Fish. Rev.*, June 1961)

Catamaran Research Ship

A research and design study to determine the feasibility of using a catamaran type vessel for oceanographic research, which was begun some months ago by a U.S. firm for the Institute for Marine Science, University of Miami, has been completed and the vessel given an excellent rating. A test carried out in the model tank indicated excellent resistance and sea keeping characteristics for a 600-ton displacement seagoing vessel of twin hull design. Observations of roll and

pitch under various sea conditions indicated that oceanographic work could be carried out in considerably heavier weather than would be possible for a conventional single-hulled craft. Structural investigation showed that ample strength can readily be provided to survive maximum forces that can occur at sea. An outstanding feature of the design, stemming from the unusually large deck areas available, is the grouping of all scientific facilities around several centre line wells for coring work located between the twin hulls. Large clear open deck areas and a stern ramp should result in increased safety and ease in handling scientific gear and extensive instrumentation. The study further showed that a single-hulled vessel, offering comparable working deck area, would cost 20 to 30% more than the catamaran. The proposed vessel is designed for shoal water as well as deep sea going operations. It will have an overall length of 42.97 m. and overall breadth of 15.85 m. Each hull will have a beam of 5.33 m. and normal draft of 2.44 m. (*Fisheries Newsletter*, July 1961)

The French Research Vessel

The Institut Scientifique et Technique des Pêches Maritimes, France has a new research vessel delivered a few months ago. What makes this vessel specially interesting is that it is equipped for stern trawling. There is no doubt that the experiences gained by the new research vessel will be followed with the closest interest by the French fishing fleet.

The vessel THALASSA has the following main dimensions: Length, o.a., 66 m. Breadth, moulded, 10.39 m. Depth to main deck, 4.44 m. Gross tonnage is 1,000 tons. The propelling machinery

consist of two Duvant Diesels, one developing 800 h.p. at 375 r.p.m., and the other 300 h.p. at 600 r.p.m. This "father and son" propulsion machinery drives a controllable pitch propeller at 200 r.p.m. A further feature of great interest is the fitting of Plueger active rudder. In the trailing edge of the rudder an auxiliary propeller is set and driven by a 75 h.p. electric motor. The hydraulic trawl winch is used for handling the trawl and power is supplied by a 200 h.p. Diesel. Further, the vessel has two hydrographical winches, one dredge winch and a winch for raising and lowering the Galeazi observation chamber. By means of this chamber observers may descend to a depth of over 550m. The freezing equipment comprises two refrigerated chambers, each of 25 m³ capacity. They are designed for temperatures of -25°C and -26°C respectively. Temperatures down to -40°C may be obtained in a freezing tunnel. THALASSA carries 24 scientists in addition to her ordinary crew of 31 men. The scientists have at their disposal 4 oceanographic laboratories, a hydrological section, a fish section, and, a library. (*Norwegian Fishing and Maritime News*, Vol. 8, No. 1, 1961).

Stern-Trawlers for Tropics

The first of a series of stern-trawling factoryships designed for fishing in tropical waters is being constructed in East Germany.

TROPIK I is specially built for fishing in central and south Atlantic waters. It can carry fuel and supplies for a 60-day trip, and it is expected that it will land 5,100 to 5,800 metric tons of processed fish and fish products annually. The vessel is 79.25 m. long and its two main motors are 670 h.p. Diesels. The crew of 76 will be housed in state-rooms, all with hot and cold water. All living and

working quarters will be air conditioned. TROPIK I differs from other factoryship trawlers in that it does not have a continuous shelter deck. The vessel is designed to fish with bottom and midwater trawls for sardines, herring, and flatfish. In addition, there is gear for catching tuna with pole and line or long lines, a fish pump for sardine fishing, and two dories 8.84 m. long with 34 h.p. motors for purse seining. For trawling and gill-netting the gear will be shot over the stern, but tuna fishing with poles will be done from platforms which fold out from the vessel's sides and stern. Small bait tanks on the platforms are filled from three large bait tanks. The fish pumps are of Soviet manufacture. The electronic equipment includes two radar sets, asdic, and 2 echo-sounders. (*Fiskaren*, 15 March 1961).

Electronic Trawl Warp

A new "electronic fishing line", developed by the U.S. firm, is being tested by the U.S. Bureau of Commercial Fisheries. It comprises a steel cable incorporating electrical conductors enabling fishermen to utilise various electronic instruments in conjunction with a trawl. A depth telemeter attached to the warp indicates how deep the trawl is fishing, enabling crews to lower or raise the nets accurately to snare a catch located beforehand by echosounding. Another instrument which can feed information through the new cable is an on-bottom indicator. This signal device is triggered by a spring-loaded switch on the bottom of the trawl door. When the sea bottom presses against it, a light shines in the pilot-house. If trawling speed is too fast, or underwater currents are encountered which affect the functioning of the trawl gear, causing it to rise from the bottom, the switch is thrown and the light goes out.

Once a concentration of fish has been plotted by echosounding, it is important to keep trawl on course and moving at a closely regulated speed. A ground indicator, similar to a speedometer, helps the crew to determine the progress of the trawl along the sea bottom without reference to wind, current or propeller speed. Impulses from this contact device, transmitted along the cable from sea depths to the crew above, also aid in manoeuvring the trawl close to on-bottom contours. Thermometers installed on the warp indicate the temperature where the nets are fishing. Fish concentrations may be governed by slight changes in temperature. By means of a device attached near the trawl door, the warp will relay changes in the strain between the net and the door, indicating whether the catch is heavy or light. And the new cable can be equipped with lights, fathoms deep, to attract fish into the trawl's path. (*Fisheries Newsletter*, June 1961).

Electrocuting Sardines

Recently experiments were carried out on the French Atlantic coast on the electrical killing of netted sardines. The experiments aim was to test the effect of instant killing in the end quality of the fish. By normal catching methods sardines lose their scales to a very large degree as a result of their lively movements and their friction against one another. Both quality and value loss are stated to be avoidable by instant killing while the fish are still in the net. The first satisfactory killing results were achieved in the recent experiments by the use of apparatus specially constructed by a West German firm. In 1956 various experimental apparatus had been used without great success. With the German built apparatus it was found possible to

kill 150 kg. of sardines in one net within ten seconds. The apparatus consisted of a 3-phase AC generator, producing 40 to 120 cycles per second without graduations and a peak potential of 400 volts. With the aid of special fittings, a current of up to 300 amps. is fed by the generator through a special switch unit and three copper electrodes into the water. One of the electrodes, which is cylindrical in shape, is set in the middle of a plastic ring and is thus able to float in the net sack. The other two electrodes consist of rectangular grids of a surface area of some 16 cm² and are fitted to long bamboo rods which are placed in the water on either side of the net sack. The 150 kg. of sardines were absolutely undamaged. It was found that a total of only 80 to 100 scales were lost by the whole catch. Tests are being carried out over a 2-year program to determine whether sardines thus killed are of better quality, storage value and processing potential. (*Fisheries Newsletter*, June 1961).

Flashing Lights to Lure Herring

Soviet experts have proposed a method of herring fishing based on the use of flashing lights mounted on the trawls. The experts made their proposals after a trip in the North Atlantic aboard the SEVERYANKA, a submarine fitted out as a scientific laboratory. If Russian experts succeed in attracting fish into the track of a trawl by artificial light, it will be a notable triumph. The reaction of sea fish to light has not been extensively studied through a U.K. research ship had an interesting experience a few years ago when engaged in a study of the pilchard fishery. A shoal had been located by echo-sounder and when a powerful light was shown over the ship's side, the shoal at once rose. The light was switched off

and the shoal immediately returned towards the sea bed. In the case of herring, in which the Russians have now a considerable interest in Atlantic waters, the fishery is greatly dependent on extensive vertical movements of the fish. At night they rise to the upper waters and are taken in drift nets. By day they seek the bottom and are taken in trawls. These vertical movement correspond to the diurnal movement of plankton and it may be the response of this herring food to light that governs the mass movement of the fish. (*The Fishing News*, 10 March 1961.)

Vertical Plate Freezer

One of the most modern pieces of equipment scheduled for the new British stern-trawler LORD NELSON, is the vertical plate freezer, experimentally built at Torry Research Station, Aberdeen, but designed on a commercial scale by a British commercial firm. This freezer has six stations in two groups of three, each formed by four special multichannel extruded aluminum plates suspended vertically from their top edges on special gaslight trunnions connections. These enable the plates to hinge about the center line of the trunnions and they can, therefore, move a part at the bottom to release the frozen fish blocks formed between them. Refrigerant flows through the channels formed in these embossed plates from the inlet to the outlet trunnion connections. Each group of four plates is fed in parallel from manifolds into which the trunnions are inserted. The rectangular slots between the plates form the moulds or stations in which the fish blocks are frozen, and the bottoms of the stations are closed during the freezing cycle by bottom doors hinged into a horizontal position, one door for each

group of three stations. Mechanical linkages between the bottom doors and the freezer plates secure the latter in their closed (paralleled) position during the freezing cycle. At the end of the freezing cycle hot gas is passed through the freezer plates to release the fish from the blocks; at the same time the bottom doors are dropped into their open (vertical) position, and this through the linkages moves the plates apart to release the blocks. The frozen blocks drop out into the nets, from which they are removed for stowing in the frozen fish hold. It is possible with this freezer to obtain a much shorter freezing cycle than with the earlier design. This has the advantage of reducing considerable space occupied by a freezing plant of any given output, an important consideration in a vessel. Special designs have been developed for freezing dressed cod after gutting and heading, and experience has shown that for Arctic cod the minimum convenient block thickness which can be used is 10 cm. Experience with 10 cm. blocks shows that with the correct evaporating temperatures and rates of refrigerant circulation, freezing times as low as three hours are possible, but in general, a freezing cycle time of $2\frac{1}{2}$ to $3\frac{1}{4}$ hours should be allowed at the design stage to compensate for variations in block weights, contact between the fish and the freezing plates, etc., this time includes that required for loading, defrosting, and unloading. A special defrost cock is available for use in conjunction with each three-station half-freezer to change over from freezing to hot gas defrosting to release the blocks. This also has had the advantage of ensuring that the plates are free from ice at the commencement of each freezing cycle. (*The Fishing News*, 17 March 1961).

Direct Conduction Freezers

A British firm announced about a year ago the development of their range of direct conduction double contact plate freezers and the drastic reduction in established freezing times made possible by their revolutionary new freezing plates. Various installations, ordered by the Government of China have the latest units, which are said to be designed for freezing times as short as 50 minutes for 5 cm. thick fish. As well as improved quality due to the faster freezing, the economies in space, offered by the ability to freeze fish at the rate of 25 tons per day in just one 15 station unit, is an important factor. Other benefits include a reduction in the investment in freezing trays and in the cost of associated refrigerating equipment. The Williams Double Contact Plate Freezer, fitted with "Direct Conduction" freezing plates, is an insulated cabinet with double doors at the front and, if straight through operation is required, at the rear also. The cabinet houses a set of horizontal freezing plates which are moved vertically by an electro/hydraulic system so that when loading and unloading the plates are opened apart and for freezing they are closed together. The layers of food resting on each plate are also in contact with the underside of the plate above and each layer of food is therefore in intimate double contact with refrigerated plates. A safety mechanism allows the product to expand during freezing. The freezers are normally operated with a liquid recirculation ammonia system at an evaporating temperature of 35°F. but freezers can be supplied for use with other refrigerants and brine. When ammonia is used a surge vessel (accumulator) and ammonia pump must be supplied with the freezer or for multiple installations a single large

drum and pump can serve several freezers. A conventional condensing system employing compound compression is required and the freezers are defrosted by hot gas by passed from the compressor. Direct Conduction plates permit high speed freezing because they are completely filled with refrigerant passages and only a metal skin separates the refrigerant from the product being frozen. Refrigerant is fed through the plates in a controlled manner and the all primary cooling surface feature of the plates, together with controlled refrigerant flow, ensures an even temperature, approaching closely to the refrigerant temperatures, over all the plate surface. (*Norwegian Shipping and Maritime News*, Vol. 8, No. 1, 1961)

Liquid Nitrogen

A New York firm has developed a machine which freezes packages of food to temperatures of -320°F. for ultra-quick freezing. The machine, which uses liquid nitrogen for freezing, has been designed to fit into the last phase of a packer's production line. It requires only 11.89 m² of floor space and has a capacity of 120 packages per minute. Packages of prepared foods in wire baskets come off the production line at 160°F. to 180°F., and on to a conveyor which conveys them through a gentle shower of liquid nitrogen. After the shower the packages are immersed in a pool of liquid nitrogen at -320°F., the immersion time being regulated to the size, type, and shape of the package. A reliquefier machine is connected to the unit so that nitrogen may be used many times thus reducing the over-all operating costs. The amount of nitrogen loss may range from 5 to 10 percent. The process can be extended to the trucker who can make use of the firm's new insulation insert designed to

utilize liquid nitrogen. It is stated that the process is competitive with the standard methods of refrigeration used in transportation. (*Comm. Fish. Rev.*, April 1961)

Photoelectric Cell and Fish Quality

The Torry Research Station, Aberdeen, Scotland, has devised a machine which will measure very quickly the condition of cod, and possibly other white fish, by measuring the milkiness of the meat. According to Torry's scientists, such a machine could help solve the difficulties of handlers and processors from seasonal variations in the quality of newly-caught fish. The new machine has shown that the milkiness of North Sea cod — a sign of poor fish — rose steadily from January to about May each year, and then fell again, presumably as more food became available and condition improved again. The final proof that condition and milkiness were related was this. It was found that the fillets go milky whenever one liked simply by starving live cod which were living in an aquarium. As the condition of the fish changes, so does the chemical composition. The scientists in carrying out chemical analyses find that the results are rarely the same from one month to the next, nor are they the same in fish from different fishing grounds. The natural variations, according to the report, are caused by spawning, and also by a lack of sufficient food at certain times of the year. When the fish are spent and starving, the meat becomes more watery and less suitable for processing. They can't be made into satisfactory smoked products, and they are soft and flabby to the touch. The amount of fat or water in the meat gives a good guide to the condition of the fish, but these measurements usually take a long time. One way to

recognize a poor fish is by the look of the fillets which are a dense white instead of being almost transparent, as they are in a well-fed fish.

In the new method of measuring this condition, a large flake is cut from a fillet and placed in the machine developed by the Torry Laboratory. A light shines on it, and the amount of light which gets through the sample is measured with a photoelectric cell. This is more sensitive than the human eye, so it can detect much smaller changes in milkiness. With this method the Torry scientists now hope to study the condition of cod at different fishing grounds and the effect of age and sex on their condition. By doing this one should be able to sort out some of the complicated factors that go to make up quality, and to find out what decides whether or not a particular fish will make a good or bad product. (*The Fishing News*, 10 February 1961)

Fish Flour In U.S.A.

A prelude to a program aimed at helping to end dietary protein deficiency, and which may prove a boon to peoples in underdeveloped areas, was given on April 4 at a luncheon at the Department of the Interior by U.S. Secretary Stewart L. Udall. Cookies were served to guests to which had been added fish flour, a convenient supplement to diets of protein-starved persons — an innovation which many believe could change the lives of countless persons in the nations of the world. Over two-thirds of the world's population suffer from protein malnutrition. The term "fish flour" is actually a misnomer, and those engaged in the research to produce this material in quantities prefer to call it "animal protein concentrate". It contains little or none of the carbohydrates and starches

found in grain flour. Rather, it contains up to 95 percent of animal protein. These proteins contain all of the 10 amino acids which are essential for the development of bone and muscle and for the daily maintenance and repair of bodily tissues. The concentrate can be made from non-utilized fishes. The U.S. alone could easily supply from one locally available species of fish and without reference to other species of industrial fish commonly available, sufficient concentrate to treat to treat 100 million humans with a dietary supplement level of one ounce of concentrate daily, for about a year. The amount could be increased many times by utilization of the numerous domestic fish species which are little used or not used at all, at present. In developing countries, where many but not all of the 10 amino acids are available from vegetable protein sources, the United States production from one species of fish alone would adequately supplement the diet of 330 million humans for a year. Major obstacles to the development of a substantial fish concentrate industry in this country is the lack of process engineering studies which would assure an inexpensive but consistently highly nutritious product. The Bureau of Commercial Fisheries, Fish and Wildlife Service, hopes to undertake such work in near future. The Bureau's home economists made the cookies used by Secretary Udall. In the amounts used, the concentrate was undetectable as to taste or appearance. Nevertheless the protein concentrate added was sufficient for five cookies to provide 14 percent of the animal protein needed daily by a 6-year-old child, and 8 percent of the amount needed by a 70 kg. United States adult male. (*Comm. Fish. Rev.*, June 1961)

Fish Flour In Mexico

A group of doctors headed by the Director, Hospital Infantil de Mexico, for the past several years, has been experimenting with deodorized whole fish flour as an additive to diets for human consumption. Some of their conclusions to date are :

Metabolic Balance Studies: Although it is still necessary to compare a larger number of cases, what has been observed so far is a clear evidence of the high biological value of fish flour to enrich a poor quality basal diet.

Clinical Studies: The results of the clinical study may be summarized: (1) Adding fish flour complement to the normal diets given to malnourished children did not modify the satiety index. (2) The expected tendency of the growth curve was not changed. (3) No allergic manifestations resulted. (4) No toxic manifestations resulted

Dietetic Study: So far, 2,800 different assays have been carried out with the following results: A practical way to add fish flour to infants' formulas could not be found whatever the mixture used in their preparation: broths prepared with cereals, vegetables, etc. It was possible to add, in varying percentage, fish flour to soups, beans, hard biscuits, cereals, tortillas, bread, pureed vegetables. The percentage found practical are: corn meal (for tortillas) 5 to 7 percent, bread 10 percent, beans 5 to 7 percent, noodles 10 to 15 percent, hard biscuits 10 percent; cereals 5 percent, doughnuts 10 percent, and pastries 10 percent. Fish flour may be added to corn meal before it is ground; to hard biscuits, it is easily added at the bakery during the baking process. To noodles (dry doughs for soups) it may also be added during preparation. It may be

added to beans after cooking, or after they are ground and ready for frying.

The stability of foods treated with fish flour has been found indefinite for hard biscuits and noodles. The stability is less for foods of immediate consumption, such as tortillas, bread, purees, soups, beans, partries, etc.; but it is sufficiently good to permit the easy and tasteful consumption on the same day of preparation, or on the next one. As fish flour is not detected in any of the foods mentioned, or at the most, there is a slight darkening of the usual color, the human groups (adults and children) in whom were tested the acceptancy, did not become aware they were consuming food with varying percentages of the complement added to it.

In another section of the report the doctors state: However, it is believed that they are on the verge of reaching a feasible and practical solution with the use of a complement of high biological value, and great nutrient power such as dedorized fish flour which would be added to basic foods without changing their taste or their odor, but that would remarkably reinforce the values of the diet. (*Comm. Fish. Rev.*, May 1961).

Radiation of Foods

A Research Institute team in U.S.A. searching for hazards inherent in the sterilization of foods by irradiation, has concluded that radioisotope activation is not harmful. The scientists said, the quantity of radioactivity in treated food is small compared with natural environmental radioactivity, and food preservation can proceed safely.

When food is subjected to high-energy radiation, radioactive isotopes may be produced in the food. Some isotopes have a half-life of only a few seconds; others

emit radiation for years. It was essential to know if isotopes are produced by radiation sterilization of foods and in what quantity, and if they remained radioactive for significant periods. To find the answers, the researchers irradiated a variety of separate elements present in foods and examined them for induced radioactivity. This was repeated with whole foods-beef, bacon, shrimp, chicken, and green beans. Container materials were irradiated and measured for induced radioactivity. A variety of radiation sources was used in each case, including cobalt-60, cesium-137, spent reactor fuel elements, X-rays, and high-energy electrons. The research team pointed out that almost all "clean" food has trace amounts of radioactivity. This results from the naturally-occurring isotopes, potassium-40 and carbon-14. The object of the project was to find radioactivity above these traces. Small quantities of sodium-22 and rubidium-84 produced by high-energy X-rays and electron irradiations, were the only induced radioactivity found in the irradiated samples of whole food. Many of the irradiated food elements, however, showed low levels. Almost all were from isotopes that have short half-lives (minutes to hours) and are not common food elements. In no case were levels found above the recommended limits for drinking water by the team of scientists from the Institute. All forms of containers were tested and found safe by the research team. (*Comm. Fish Rev.*, May 1961.)

A Pharmacological Method for Killing Sharks:

In examining hazards met by divers around Australian shores it seemed a new idea was needed to enable progress to be made in the defence against sharks. A search showed that camphor, analeptic to

man, was allegedly depressant to cold-blooded creatures. A method of trial by injection into sharks was sought. Tank observation of captured sharks and another method, cage protection of observer and 'berleying', were found to be too cumbersome and costly.

With three champion spearfishermen, D. Rowling, R. Taylor and T. Louis (the first two of whom invented a metal syringe with an ingenious non-return device for use with the standard, widely used, 'Hawaian Spear') camphor, 50 per cent. in chloroform, was first tried in the open sea on Port Jackson sharks (*Heterodontus portus jacksoni*). Ready diffusibility of both substance was established. Even the tip of a tail or fin taken half an hour after injection smelt strongly of camphor and chloroform, especially the former. Death of the shark by this method, however, was not obtained in less than 20 minutes.

Throughout 1960 and early 1961, by using modern techniques of diving and taking advantage of the presence of the large numbers and varieties of sharks in N.S.W. coastal waters, it was possible to investigate nearly thirty substances, including commonly known poisons and recognized (though ineffective) shark repellants. Between forty and fifty sharks were injected, chiefly of common varieties—*Heterodontus portus jacksoni*, *Orectolobus* (carpet sharks and wobbegongs) and small specimens of *Carcharius* (grey nurse) and other faster swimming sharks. Large sharks were encountered but could not be safely or suitably injected by the technique and the untried materials then available. Notes of all tests and some photographic records were made. A problem with all preparations tried was to obtain high concentration in low volume in a diffusible form. Safety of handling

was a consideration in relation to use both above and below the surface.

Some substances tested, including such powerful poisons as potassium cyanide and various forms of curare, were surprisingly ineffective. No irritant poisons tested gave a rapid result. Enough magnesium sulphate with chloral hydrate to bring down several large horses made no detectable difference to each of several small sharks, except to increase their swimming speed. Hyaluronidase was without measurable effect on diffusion rate in the quicker acting substances.

Sharks being atavistic creatures have an anomalous autonomic system. Responses to adrenergic and cholinergic substances were correspondingly disappointing. This subject, possibly containing in it somewhere a vulnerable point in a shark's physiology similar, for example, to its high blood urea level (about 2 per cent.), seemed worthy of investigation. However it was abandoned as strychnine nitrate was at that time found effective.

Many successful trials of strychnine derivatives on small sharks were made. It seemed a series of large sharks should be tried in circumstances in which they could be held and the results observed. A whaler (*Caleolamna macrurus*), weighing about 1200 lb. and nearly 10 ft. long was captured and held in a net in Rose Bay, Sydney Harbour. Tethered by a rope round his tail he could swim to the bottom or move about as he wished. Proof of his lively state was made by attempting to lift his tail into a boat. Each time he vigorously lashed around and freed himself, swimming hard to the end of his line. Five ml. aqueous strychnine nitrate 1 in 50 fresh saturated solution, were injected into the dorsum just

anterior to the large dorsal fin and slightly left of the midline. A small quantity of the fluid appeared to escape around the needle. To compensate for this an additional 2 ml. were injected nearby. In half a minute coordinated movements of the shark ceased. Jactitations, twitchings and spasm appeared and it lay with head and tail strongly flexed to the left, the reaction many times obtained previously with smaller sharks. In two minutes he could be handled and was dragged into shallow water, then to the beach. The strong erection and spasm of the claspers with spread of their peculiar hood mechanism was noted, as seen in previous male specimens at this stage. It was demonstrated that his heart had already stopped in less than the eight minutes which elapsed between giving the injection and displaying his heart by surgery. In many instances a shark's heart may still beat 24 to 36 hours after he has been landed or placed in a boat. Routine post mortem dissection was carried out. The shark was found to have been in good health and his stomach well filled with fish in various stages of digestion.

In practice, strychnine nitrate, 1 in 50, fresh saturated, aqueous solution, was found superior to strychnine alkaloid, either aqueous or in 1 in 6, and to strychnine-brucine mixture, either aqueous or in chloroform. It was also superior in our estimation to an aqueous solution of strychnine hydrochloride, 1 in 40.

It seems clear that, where certainty rather than rapidity of death of a shark is the aim, strychnine alkaloid in chloroform 1 in 6 is the best agent, introducing as it does a high dose in a very low volume. It is probable that the chloroform is a pharmacological antidote to the

strychnine but this effect would be minimal in the large dose of strychnine which it conveys. If, however, rapid death is sought a fresh saturated aqueous solution of strychnine nitrate seems best for the purpose. Strychnine phosphate, although even more soluble than either, was not available in Sydney for trial.

It is recognized that there are a number of common substances, such as colchicine and mercuric chloride, further up the human toxicity gradient than strychnine, and more powerful substances such as 'nerve gases' exist; but up to the present they have not been tried as the safety of the spear fisherman in the water must also be considered.

There now seems need to produce a syringe-spear—a 'Spearing', if one may coin a word—for underwater use with a standard spear gun. This would be automatically discharged on striking the shark as opposed to the 'Hawaiian Spear' method which depends on the diver to continue the pressure by hand. When such a mechanical device is available, further trials on large sharks in their natural environment will doubtless be carried out. Effective means may then be found of stopping a shark committed to 'mob feeding' attack. ('Mob feeding' is the wild, uncontrolled dashing about and biting at anything that occurs when a number of sharks are competing for food. In contrast is the selective feeding of the shark which circles his prey, possibly for some considerable time, and with a livening interest shown by the jerky swimming and vigour of tail movement. Such a shark is an easier target than the frequently caught king fish.)

We are grateful for advice and encouragement from Professor Ruthven Bickerton Blackburn; for valuable suggestions from Dr. V.M. Coppleson, authority

on shark attacks; to the Wellcome Company for drugs; to Parker's Pharmacy, Potts Point, for materials and help in their preparation; and for assistance from Naval personnel, the Royal Motor Yacht Squadron and from spear fishermen friends.

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18 June 1961

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Carp Breeding

The Central Inland Fisheries Research Station, Barrackpore, has reported (*Indian Fisheries Bulletin*, VIII, 1961) the large scale production of fish seed by inducing major carps to breed by administering pituitary hormone. During the season June-September 1960 a total of 13,800,000 spawn were produced of which 8,200,000 fry survived and were stocked in the nursery ponds. All the major carps, Catla, Rohu, Mrigal and Calbasu were successfully and repeatedly induced to breed during the season.

The Chinese grass carp and silver carp are being reared to maturity at the Sub-Station at Cuttack and a program of pituitary injection experiments will be undertaken at the appropriate time. It is of interest to note that the Cuttack experience has shown that the grass carp grew very rapidly in ponds containing an abundance of submerged weeds but in ponds devoid of larger submerged aquatic vegetations, the growth of the grass carp was poor, in spite of artificial feeding with oil cake.

Preliminary observations have shown that a pond choked with *Hydrilla* can be cleared of the weeds completely in the course of a month if yearling grass carp (200-300 grams in weight) are introduced at the rate of approximately 375 per hectare.

The State of Maharashtra also reported satisfactory use of pituitary hormones in Mrigal and Rohu resulting in the production of over 200,000 fertilized eggs.

Hybridization between Catla and Rohu and between Rohu and Calbasu have produced interesting results. The Catla-Rohu cross has grown almost as well as Catla, has a deeper body than Rohu and a smaller head than Catla. By pituitary injection, breeding has been induced in Rohu-Calbasu hybrids with the production of viable fry. (See also p. 22)

Cross Breeding between two species of Caridinean Prawns

Studies on the prawns of Bombay have been in progress for the last two years at the Taraporewala Aquarium. During these investigations, an attempt was made to cross-breed two species of fresh-water prawns, *Caridina weberi* var. *sumatrensis* and *C. rajadhari*. A notable result was achieved in getting the hybrid larvae which differed from the larvae of the parent species. The hybrids were reared to the adult stage which not only differed from the parent species, but showed some characteristic which are not present in the genus. The hybrids were bred and F₂ generation was also obtained showing segregation of characters. This cross-breeding is believed to be the first successful venture in decapod crustacea, opening a new field in Crustacean Genetics.

NEWS FROM THE REGION

AUSTRALIA

The 1961 conference of Commonwealth and State fisheries officers was held at Perth, May 29-June 1. All States were represented; also Fisheries Division, Department of Primary Industry; Division of Fisheries and Oceanography, CSIRO.

Some of the Conference decisions and recommendations included the following:

Fisheries Management: That fisheries authorities should: Examine present regulations with a view to repealing obsolete provisions; Accept that stock assessment be a prerequisite of fisheries management; Accept that the general aim of management in relation to major fishery stocks should be to maximise the yield; Consider ways of maximising the return to fishermen consistent with maintaining maximum yield; Accept that wherever possible, specifications of gear to be used and places where fishing may be restricted should be based on the result of field tests; Carry out follow-up tests to assess the effectiveness of new regulations.

Statistics: Conference adopted a report by the Statistics Committee and agreed that: The model system contained in it be used as a basis for the collection and tabulation of catch and effort statistics in Australia; The Commonwealth Statistician be asked to review (on the advice of the States, CSIRO and Primary Industry) a table of factors for converting the weight of fish from landed to live weight; The States should inform the Statistics Committee of the species on which they want effort statistics to be collected; When the revised system of

collecting catch statistics is to be implemented, it should be adequately publicised the Statistics Committee to prepare draft material for this purpose.

Training: Conference endorsed in principle training proposals for extension workers, fisheries inspectors, and other staff, and appointed a Standing Committee to give effect to them.

Speed Boats: Recognising the adverse effects of speed boats on estuarine, bay and inland fisheries, conference recommended that they be registered. There was need to provide for speed boats, and to enable them to recognise fishing operations in progress, fishing boats should display fishing signals as provided by the Navigation Act.

Economic Research: Conference appreciated the need for development of economic research into Australian fishing industries and suggested that research into the marketing of fish and fish products should be given high priority.

Tiger Flathead: Recommended that investigation of east coast tiger flathead resources be resumed as soon as possible by CSIRO and Department of Primary Industry as a step towards management measures to rehabilitate the fishery,

Fish Culture: Recommended that the fullest use should be made of inland waters for commercial fisheries and recreation; that the desirability of a priority for native species, and importation of exotic species of food fishes, should be examined. Conference endorsed the proposal to import from Europe, for controlled experiment, eggs of a domesticated variety of the European carp (*Cyprinus carpio*).

Quality Standards: Recommended that possible fields of research into fish and fish products should be studied. It was agreed that the handling and processing of a technique to detect milkiness in barracouta at the port of landing, required immediate attention.

Technological Research: Recommended that Primary Industry and the States investigate, and report to next conference, on possible fields of research on gear and fishing boats.

The annual report for 1960-61 issued by the CSIRO Division of Fisheries and Oceanography states that, during the last 12 months the fisheries program has been given a new orientation by the establishment of a cooperative program in which four States and two Commonwealth Departments of Fisheries collaborate in an investigation of pelagic fisheries resources on South-east Australia.

Oceanographic work has continued with observations from fisheries vessels and with 7 cruises on the oceanographic

frigates of the Royal Australian Navy. Four of these cruises were in the Indian Ocean and three in the Pacific. Because of the volume of data from these investigations increased attention has been given to data processing, most of which is now done by electronic computer.

In connection with the oceanographical studies, the Division has perfected an salinometer which measures the amount of salt in seawater by an electrical conductivity method. Measurements can be made to 0.0003 parts per thousand.

Research of marine fouling organisms is being continued and in the studies of growth of invertebrate larvae, a supply of food of these has been ensured by the perfecting of an Algal Mass Culture Unit.

The program of studies in fisheries oceanography, fish taxonomy and fisheries biology has been developed with emphasis being placed on tagging studies, measuring and sampling spiny crayfish and studies on age determination and growth.

During the year, 51 articles were published or submitted for publication.

BRUNEI

Shrimp Fishery in Brunei

According to a statement by the Government of Brunei, there is no organized shrimp industry in Brunei. Shrimp are usually caught near the shore. The fishermen wade into the water, at times shoulder high, each one pushing a net in front of him. Little or no shrimp fishing is done from boats. Therefore, the catch at times is considerable and at other times negligible. Catches are seasonal and depend on localities. It is said that large catches are obtained in Brunei Bay during one short period in the year,

usually about February. From the open seas the shrimp come inshore in large numbers, perhaps once every one or two months. Shrimp fishing is a village industry. There are no freezing, canning, or other plants in Brunei. The catch is normally made into paste (Belachan) or dried. Such processing is done by the fisherman and his family. A small portion of the catch is sold fresh in the local market. No statistics are available for the total annual landings of shrimp, which are made up of two varieties. The smaller and more abundant variety is

known locally as "bubok buyah". The larger, averaging about 4 cm. in length, is locally known as "bubok tambak". There is no export of shrimp or shrimp products from Brunei. The catch is insufficient to meet local demand and all shrimp fishing is a family-type venture.

Any possibility of expanding the industry is dependent on the discovery of further fishing grounds. However, little or nothing is known on this aspect and considerable research would be required before a substantial expansion could be attempted. (*Comm. Fish. Rev.*, May 1961).

BURMA

New Fishing Companies

A Burmese fishing firm and a Japanese fishing corporation have established a jointly-owned fishing company and the capital for the project has been fixed at 15 million kyats (US\$3.1 million). Profits will be shared on a 60-40 basis, with the Burmese company receiving the larger share. The Japanese firm will furnish the fishing fleet—two 240-ton motherships and 24 carrier and fishing vessels. The two motherships and four of the vessels were scheduled to arrive by the end of January, with fishing due to start in February 1961. The Burmese partner is to undertake to obtain fishing licenses, meet local operating costs, and act as selling agent. Operations will take place along Burma's coast, and the motherships will cure fish and shrimp

and manufacture fish paste on board, putting into port at long intervals to discharge the products.

Formation of another fishing company, a joint venture of the Government's Defense Services Institute and a Singapore fishing company, is also reported. The Institute is reportedly providing security and supervision through its Burma Fisheries Limited, and the Singapore company providing trawlers, crews, and equipment (*Editors note*: the enterprises operated by the Defense Services Institute are now taken over by the Burma Economic Development Corporation, also a Government sponsored body). Two vessels of the joint venture made a good catch of eastern shad weighing about 9 tons on their first trip in December 1960, off the Cape of Negrois, Bassein District. (*Comm. Fish. Rev.*, April 1961).

CEYLON

Fisheries Training Center

An agreement was signed in Ceylon on 20 March 1961, between the Governments of Ceylon and Japan, to establish a Fisheries Training Center at Negombo, a fishing town on the coast above Colombo. The project was originally offered by Japan in August 1958 and details were discussed in February 1960.

The training to be provided at the Center will provide: (1) courses in

fishing gear for 20 trainees, every four months, selections being made by the Government of Ceylon from local fishermen who will in turn carry the benefit of their training to their fellow fishermen in their villages; (2) courses in the operation and maintenance of marine engines—ten trainees will be trained every year; and (3) instructions in general aspects of the fishing industry.

The Government of Japan is to send

a training vessel and other equipment as well as eight Japanese experts. Capital aid from Japan over the three-year period of the agreement will amount to Rs. 1.3 million (US\$274,000). The Government of Ceylon is to provide the buildings, accommodations, Ceylonese student staff, and running expenses, incurring capital expenditure of about Rs. 250,000 (\$53,000) and annual recurrent expenditure of about Rs. 60,000 (\$13,000). The project is expected to be of practical benefit to

Ceylonese fishermen to enable them to keep pace with the mechanization program. About a year ago, a team of Japanese experts visited Ceylon and drew up a report on the potential development of a network of small fishery harbors in June 1960.

Japanese interests own 45 percent of a Ceylonese fishing company which catches tuna in northern waters for canning in Japan and export to the U.S. (*Comm. Fish. Riv.*, June 1961).

INDIA

The following contains extracts from the Quarterly Report of the Central Inland Fisheries Research Institute, Barrackpore for the period ending 30 September 1960.

Induced Breeding Of Indian Carps:

Experiments on induced breeding of major carps by pituitary hormone injection, aiming at large-scale production of fish seed, were successfully carried out during the quarter under report. Difficulties were encountered at the beginning of the quarter when the water condition in the ponds and channels were not very suitable for the successful hatching of eggs. By the middle of August, the breeders started oozing. The quantity of spawn produced during the quarter exceeded 7.7 million. Altogether, nearly 13.8 million of spawn were expected out of the successful spawning of major carps in this season. But due to adverse factors like excess of algal blooms, depletion of oxygen etc., a large number of hatchlings died in the hatching hapas. Spawn were also lost due to sudden rise of water level in the river. Altogether 8.185 million of spawn of Catla, Rohu, Mrigal and Calbasu could be obtained for stocking in nursery ponds. Approximately

3.8 million of spawn were delivered to the Orissa State Fisheries Department.

Of all the major carps, Rohu predominated, over others as the number of breeders of the species were more. The stock of Catla breeders was not satisfactory and only 9 females were available for the experiments. The maximum weight of Catla female was 5.5 Kg. and the same laid only about 5½ lakhs of eggs. The largest Rohu which bred successfully weighed 5.7 Kg. and laid nearly 1 million of eggs, the percentage of good eggs being 95. A female Mrigal weighing about 4.8 Kg. laid 1.16 million of eggs of which over 90% hatched out.

In fish breeding experiments aiming at the standardisation of doses, records of sex, length, weight and stage of maturity of donor fishes were maintained. Individual glands were preserved, weighed separately and doses calculated in mg. weight of the gland per Kg. of the body weight of the breeders. Although it is very difficult to determine the exact stage of maturity in a female fish from external examination, attempts were made to select good breeders by examining characters like round and bulging nature as also softness of the abdomen. Over

one hundred breeders were injected and successful results were obtained in 60% of the experiments.

A good number of Rohu-Calbasu hybrids were observed to have matured fully. One set of the hybrid with two males and one female was injected with Rohu pituitary gland. The female laid over one and a half lakhs of eggs after the second injection and 65% of the eggs hatched out. 40,000 of the hybrid spawn were stocked into a nursery pond and a few thousand were reared in the laboratory. Although survival rate of fry in the pond was very poor due to a large population of Notonectids, the growth was quite satisfactory. These hybrids show great variations in colouration of the body, fins, barbels and caudal spots. Detailed study of the variations in the offspring is in progress. Over 3.7 million spawn of major carps and *Cyprinus carpio* have been received in the nurseries at Killa, Zobra, Puri Brick Field farm and Choudwar farm. Over 1.2 million of fry were netted out from the nurseries except from Choudwar, where due to floods no fry could be obtained out of the 600,000 spawn of Catla, Rohu and *Cyprinus* stocked.

Breeding of the Common Carp *Cyprinus Carpio*: As most of the nurseries were kept engaged in rearing carp spawn obtained from induced breeding, the breeding of common scale carp was taken up on a very limited scale only. The total production of spawn during this quarter was just over 1.8 million, out of which about 1.15 million were handed over to the State Fisheries Department. The production of advanced fry was over 182,000, from which 131,000 were supplied to the same department.

Scale carps weighing about 80 g. each had been introduced in a portion of the

Killa channel in April-May and these were found to have attained an average weight of about 840 g. during the quarter under report, the maximum individual weight being 1.4 Kg.

Observations On Chinese Carps: The silver carps stocked in channels and rearing pond showed good growth rate during the quarter. The maximum size attained was 635 mm. weighing about 3.2 Kg.

The growth rate of Grass carp was not as satisfactory as that of Silver carps. However, there was marked improvement in their growth after they were introduced in the weed infested ponds and also by feeding them with cut-weeds like *Hydrilla*. Now the maximum size of fish is 459 mm. and weight just over 1.31 Kg.

Observations On Other Exotic Fishes: Of the ten specimens of Gourami brought in September 1959, one female and one male (as determined from their secondary sexual characters) are surviving. The female is 307 mm. in length and weight 568 g. while the male is 278 mm, long with a weight of 340 g. They are kept together in a nursery pond and suitable material like small baskets, coconut fibers etc., have been provided for their breeding.

The production of *Tilapia* in the one-acre pond entered the fourth year by this month. The harvesting figures for one year from September 1959 to August 1960 were; number harvested, 8,100; total weight, 1,024 Kg.

Observations on mono-sex culture of *Tilapia* were continued. During the quarter under report. 101 males weighing 23.9 Kg. were harvested from two stocking ponds.

Fish Culture In Paddy Fields: Paddy field plots at the Central Rice Research

Institute were prepared in a slightly different way with square pits instead of narrow ditches as made earlier. After transplanation of the paddy, the plots have been stocked with fingerlings at a definite gate and ratio. Weekly samples of plankton and water were collected to observe availability of fish food and dissolved nutrients.

Studies On Soil Composition & Fish Production: Examination of soil condition and water quality was continued in the twelve tanks in six fish farms of Orissa. The results practically showed the same trend of variations as observed previously, i.e., soil reaction continued to be slightly alkaline or slightly acidic, available soil phosphorus was relatively higher in tanks relatively more productive and available nitrogen fluctuated irregularly. After clearing the previous year's stock of fish, the tanks have again been stocked with carp fingerlings at a uniform rate of 2500/ha. and uniform ratio of Catla, Rohu and Mrigal (1:1:1).

Experiments to study the effect of trace elements have been taken up in six cement cisterns under controlled conditions. Two cisterns have been kept as control, two have been treated with Superphosphate alone (100 kg./ha.) and the remaining two have been treated with Superphosphate (100 Kg./ha.) and Manganese sulphate (1 Kg./ha). It was observed that after the treatment there was a rise in soluble inorganic phosphate in treated cisterns. Plankton concentration (estimated gravimetrically) showed an increase both in phosphate treated cisterns, and in those treated with phosphate and trace element. The maximum was noted in trace element-treated cisterns.

Investigations to determine the micro-nutrient status of the piscicultural tanks in Orissa have also been taken up.

From a preliminary survey, it was noticed that Angul, Choudwar and Sambalpur ponds show relatively high Manganese and Iron than Berhampur ponds.

Laboratory experiments taken up with different phosphorus levels (4, 8, 12, 16 mg./100 g.) showed that generally the total plankton concentration (estimated microscopically) was more with higher phosphorus levels. However highest concentration was not always corresponding to the highest phosphorus levels. In field experiments taken up in nursery ponds where the net plankton was estimated volumetrically, it was observed that the relative increase with higher phosphorus levels was not so marked.

To study the response of different soil phosphorus levels to the production of fish (spawn stage), a field experiment was taken up in six tanks at Linghipur with two different phosphorus levels (4 mg./100 g. and 8 mg./100 g.). The tanks were stocked with spawn of *L. rohita* obtained by induced breeding and reared for one month, rate of stocking being same in all the tanks. It was found that by raising the phosphorus level from 4 to 8 units (mg./100 g.), a definite increase in fish production (spawn stage) was observed, the production ratio being 1 : 2.6.

Studies on the comparative efficiency of Superphosphate, bone meal and organic manure (cowdung) in fertilising low nutrient acidic soils were taken up in twelve Linghipur pods. Assessment after one month showed that lowest production was obtained with bone meal and highest with organic manure (cowdung).

Aquatic Weed Control Investigations : Three 0.5 hectare tanks at Kausalyaganga are being used to determine the comparative usefulness of ammonia, urea and manual methods in clearing weeds and

weed fishes. Though the experiment has been partially vitiated by floods, the observations are being continued.

There was no regeneration of *Hydrilla* in cement cisterns treated with ammonium sulphate at 200 p.p.m. even after six months. 200 p.p.m. of borax gave only initial effect.

Preliminary observations made in 15 ponds at Kausalyanga on the comparative fertility values of oil cake, cowdung, urea and ammonia in the production of fingerlings of fish indicate that best production is with oil cake and the next best with ammonia and cowdung. Percentage of survival is in the order oil cake, cowdung, ammonia, control and urea, but best growth is observed with cowdung and in control, next by urea and least with ammonia.

Autecological studies on *Ottelia* have been completed and similar studies have been started on *Lagerosiphon*. Observations on the viability of seeds on *Ottelia* and turions of *Hydrilla* were continued.

Stream Pollution Studies: Studies on the impact of pollution of sugar and distillery wastes on the fisheries and biota of river Doha were continued. Due to floods the bottom of the river had been enormously silted, blanketing major signs of pollution, excepting in areas immediately below the outfall of effluents. But no-where in the river, B.O.D. exceeded 10.00 p.p.m. and D.O. diminished below 5.4 p.p.m. Fish life becomes scarce at 3.4 miles down Siwan and entirely disappears between Siwan Sugar Mills and S.K.G. Sugar Mills. There is a progressive increase of younger forms from Gogra. Preliminary surveys for studies on the industrial pollution and effects upon fish life in Damodar river and the connected Panchet Dam were completed during the quarter under report.

Studies on The Culture of Brackish-water Fishes: To assess the relative efficacy of organic and inorganic fertilizers, the ponds at Kirgachi-Madeli fish farm were treated with N:P:K, (10:10:6) and decomposed leaves of *Sonneratia apetela* separately. The ponds were stocked uniformly with mullet fry at the rate of 3,800 per hectare. It appears that the chemical fertilizer was more efficacious in increasing the growth rate of fish than the organic manure. The average weight attained by an individual fish in control ponds manured with organic and inorganic fertilizers was 4.6, 3.83 and 5.06 g. respectively, indicating that the organic manure tried has no beneficial effect in increasing the growth rate of fish. The experiments are being continued. The production of algae in the ponds was very low. Salinity, pH, Na and P (soil phase) ranged between 0.5 and 16.4%; 6.8 and 7.2; 10.1 and 23.9 and 1.99 mg./100 mg. respectively. New fry collection centres were located near the mouth of the estuary and percentage of fry of *M. cephalus* and *L. trosscheli* was found to be very high.

Investigations on the influence of different salinities on the physico-chemical changes in the soil and water were continued. Considering the figures for ammoniacal and nitrate nitrogen in the supernatant water, it appeared that salinity ranging from 10 to 20% was the most suitable for maintaining a higher concentration of available nitrogen in the water. The exchangeable nitrogen in the soil appeared to decrease gradually with increasing salinities upto 20%, but showed a rising trend with the further increase.

The effect of salinity on the calcium content in the supernatant water and the exchangeable calcium in the soil was also

studied. The results showed that with increasing salinity the exchangeable calcium in the soil decreased.

Investigation on Sunderbans Fisheries: Bottom contour surveys and exploratory fishing in Sunderbans estuarine waters with the research and exploratory fishing vessel M.V. SUNDERBANS were continued. The river Hooghly and other tidal rivers of Sunderbans area were very rough during the season and so exploratory fishing was confined to the river Saptamukhi and other smaller rivers like Calchiraganga, Gobadiaganga, Saghchirani and Martins' creek. Efforts were made to ascertain the fishing possibilities near the mouth of Muriganga (Fraserganj), and Saptamukhi (near about Bakkhali), but due to the presence of high waves, the efforts were ultimately given up. However, the river Saptamukhi up to the northern tip of Lothian Island was explored quite extensively and was found suitable for fishing operations even during monsoon months.

Harpodon nehereus was the most dominant of the fishes landed during the quarter. Two main size groups, 4.0–10.9 and 11.0–29.0 cm., having modal lengths of 8.5 cm. and 15.5 cm. respectively, were present in the catch. Sciaenids constituted 22.93% of the total catch and was represented almost exclusively by *Pama pama* of size group 5.0–28.9 cm. having a modal length of 14.0 cm. Catfishes comprising of *Pangasius pangasius*, *Arius* spp. and *Osteogobius militaris*, constituted 11.06% of the total. Rays were next in the order and accounted for 10.28% of the total catch, *Trygon bleekeri*, *T. wagla* and *T. sephen* being the species present. Clupeids (4.37% of the total landings) were represented mainly by *Coilia ramcarati*, *Setipinna taty* and *Pellona* spp. Prawns (3.73%) were represented

mostly by *Penaeus indicus* and *Parapenaeopsis sculptilis*.

Fisheries of The Chilka Lake: In the quarter under report prawns formed 61.9% and 66.7% of total production in July and August respectively. Mulletts contributed 7.0% and 6.4%; Catfishes 6.5% and 10.4%; Sciaenids 12.1% and Perches 2.3% and 0.5%. The dominant species among prawns were *Penaeus indicus* *P. semisulcatus* and *Metapenaeus monoceros*. Among mullets *Mugil cephalus* was most important forming 4.5% and 4.8% of the total production in July and August respectively. *Pseudosciaena albida* was the common sciaenid and *Eleutheronema tetradactylum* the most dominant threadfin.

In the central sector prawns formed 77.7% and 86.4% of production in July and August respectively, *Penaeus indicus* being the most dominant species. Among the rest were mullets (9.6% in July and 7.2% in August), perches (7.2% and 0.1%) and threadfins (1.8% and 7.8%). Catch-per-unit-of-effort with departmental gill nets in the central sector, during July and August, were 1,434 and 778 g. respectively. The species composition in July was 42.1% sharks, 23.8% *E. tetradactylum*, 8.1% *Caranx* sp., 5.5% *Pleotus canius*, 5.4% *Mugil speigleri* and 3.5% *Nematalosa nasus* and in August 33.4% *Eleutheronema tetradactylum*, 15.5% *Scylla serrata* 13.1% *Pseudosciaena coibor*, 11.7% *Mugil speigleri*, and 6.9% *Thrisocles* sp.

The fishery of the Southern Sector comprised of 79.5% and 65.7% prawns, 16.5% and 13.7% mullets, 1.2% and 10.6% perches and 2.0% and 5.5% threadfins in July and August respectively. Among prawns most prominent species in both the months were *P. indicus* (31.8% and 30.0% respectively) followed by *P. semisulcatus* (10.7% and 1%) and *Metapenaeus*

monoceros (6.7% and 7.8% respectively). Catch-per-unit-of-effort (catch/night) with departmental gill nets was 1,271 g. in July and 2,198 g. in August. The composition was 21.0% *Eleutheronema tetradactylum*, 16.3% *Caranx* sp., 14.2% *Pseudosciaena albida*, 13.6% *Pangasius pangasius* and 13.4% rays in July and 64.3% *Caranx* sp., 18.7% *Eleutheronema tetradactylum* and 3.7% *Megalops cyprinoides* in August.

The fishery of the Northern Sector consisted of 58.6% and 53.5% prawns in July and August respectively. Prawns were followed by sciaenids (14.4%), mullets (8.4%), and catfishes (7.7%), in July. In August catfishes formed 18.0%, sciaenids 9.6%, mullets 5.5%, *Beloneformes* 5.3% and threadfins 4.4%. *P. indicus* was the most dominant species among prawns, *Mystus gulio* among catfishes and *Thrisocles* sp. (4.7%) followed by *Hilsa ilisha* (3.0%) among clupeids.

Catch-per-unit-effort with departmental gill-nets was 646 g. in July and 328 g. in August, the same in Satpara sector being 1113, g. and 661 g. respectively.

Large-scale inward migration of *M. cephalus* commenced in May and continued till August, 1960. The size at recruitment of the species in the fishery of the lake varies a great deal and during the period May–August, the modes appear to shift irregularly from 113 mm. class to about 288 mm. class. This is probably the result of appreciably long breeding season of the species. There are 3 modes at 138 mm, 288 mm. and 488 mm. discernible in July, which seem to represent fish of the year, one and two year olds respectively.

Pseudosciaena coibor was the most commercially important species of sciaenid available in the lake. 23.1% of adult

females examined showed immature ovaries, 74.4% maturing and mature ovaries and 2.6% spent ovaries. Fecundity increased to 23,27,500 in 728 mm. long specimen, from 23,750 in 247 mm. specimen. Juveniles were seen to occur in Patna Jal catches near Daya River mouth. The congregation of mature specimens and the occurrence of juveniles and spent females in the vicinity of Daya River mouth show that probably the species breeds in that part of the lake.

Eleutheronema tetradactylum was the most dominant threadfin found in the lake during the quarter. Juveniles of the size-range 51-77 mm. were observed to occur in large numbers in Patna Jal catches during July and formed a mode at 88 mm. class in August. The December (1959) brood which formed a mode at 113 mm. class in May 1960 may be traced upto 188 mm. class in August. Stomach contents of fish upto 100 mm. total length showed 65.7% Mysids (*Macropsis* sp.), 24.6% Amphipods (*Orchestia* sp.) and 6.8% Copepods (*Pseudodiaptomus* sp.). Larger sizes of *E. tetradactylum* subsist on prawns (*P. indicus* and *M. dobsoni*), fish (mostly *Mystus gulio*) and stomatopods (*Squilla* sp.).

Routine observations on the physico-chemical conditions were continued. Water temperature ranged from 28.2°C to 30.3°C. PH from 8.1 to 8.4; transparency from 11.5 to 45.1 cm. and salinity from 6.89‰ to 17.29‰. Total alkalinity, D.O., Silica, Phosphates, Iron and Nitrates were estimated as usual.

The biological data collected from experiments conducted both in the field and under laboratory conditions have been analysed. The earlier finding that there is great increase in zoo-plankton production on applying the first charges of jute was again confirmed. The bloom

gradually decreases with addition of jute. Further observations also have shown that it may be possible to arrive at a safe limit for the quantity of jute that may be used for each tank or pond where retting operations may take place.

Attempts to artificially infect fish in laboratory aquaria with "Dropsy" disease proved successful. This was achieved by using the fluid collected from body cavities of infected *Catla*.

Incidence of "Dropsy" disease in two more fisheries in the suburbs of Calcutta was studied. These infections were apparently in their early stages and were confined to *Catla* only. Laboratory cultures made from the infected specimens are under examination.

Further collections of parasites were made from samples of *Hilsa* collected at Howrah market and they are being identified.

JAPAN

Fish Sausage:

One of the largest Japanese fishing companies has completed the construction of a three-story fish sausage-ham plant and a four-story cold-storage plant (capacity 4,000 metric tons), including a freezing plant capable of freezing 30 metric tons of fish in eight hours, at Kurihama. Facilities include a research laboratory and quarters for company personnel. Total construction cost was

one billion yen (US\$2,777,777). The new fish sausage-ham plant is capable of producing 600,000 pieces of fish sausage and hams. The firm has other fish sausage plants, one in Sapporo, Hokkaido (daily capacity 50,000 pieces), one in Ishinomaki, Miyagi Prefecture (daily capacity 30,000 pieces), another in Hiroshima (daily capacity 30,000 pieces). The daily productive capacity of all four fish sausage plants now totals about 700,000 pieces. (*Comm. Fish. Rev.*, June 1961).

KOREA

Under the five year plan, the fishing industry will receive major emphasis on the construction of fishing craft and modernization of equipment in order to enable annual fisheries production to rise from 352,000 tons in 1960 to 593,000 tons in 1966 (*Far Eastern Economic Review*, 17 August 1961).

The Central Fisheries Experimental Station, Pusan has launched an extensive program of training and extension service in the field of fish processing technology during 1961. The training courses includes the number of trainees were as follows:

Fish handling and frozen products	27 men
Salt curing and extension work	82 ..
Boiled dried anchovy preparation	52 ..
Fish Canning	30 ..
Fish liver oil	28 ..
Agar-agar making	35 ..
Freezing of ice making	52 ..

The extension work included mechanical and natural agar-agar plants. The trainees were mother people from the industry but some Government employees also took part.

FEDERATION OF MALAYA

Progress reports of the Fisheries Division for the period April to September 1961, indicate that total fish production was less than the landings of the same period in 1960, totalling approximately 173 million lbs.

The progress of mechanization is shown below in the Table which gives the number of new mechanized craft registered.

	<i>3rd Quarter</i>	<i>2nd Quarter</i>	<i>1st Quarter</i>
	<u>1961</u>	<u>1961</u>	<u>1961</u>
Inboard	320	345	238
Outboard	362	270	120

The rate of mechanization increased sharply in this period with a bias in favour of outboard motors particularly in connection with the mechanization of the new Jaring Udang units in North Selangor.

Gear Technology :

Three purse-seine nets made entirely of Saran N were recently introduced in the North-East Region, each being 421 m. (230 fathoms) long and 65.8 m. (36 fathoms) deep. During the early part of the period when conditions were calm, light-fishing for Ikan Talang was carried out with reasonable success by the Kuala Kedah Pukat Jerut fleet. An experiment with the Japanese Set-Net (Techi-Ami) was carried out towards the end of June, but the results were somewhat discouraging. The experiment was carried out in the vicinity of Pulau Ketam in depth of about 9.14 m. (5 fathoms) water on a muddy sea-bed. The operators were Japanese under the management of a Japanese firm working in conjunction with a Fishermens Co-operative Credit and Marketing Society, the object being to explore the efficiency of this gear under

local conditions with the ultimate aim of using it as a replacement for fishing stakes. The operation is now in abeyance pending modification to suit the net to local conditions.

A Set-net (Otoshiami) experiment was carried out successfully with the help of two Japanese experts by the Hock Huat Co., Penang, off Biden Island. The catches compared favourably with other fishing methods and a number of good quality fish like bawal puteh, bawal hitam, parang, timah, pelata and tenggeri were caught.

Co-operatives :

The East Coast Co-operative & Marketing Union Ltd. handled 5,496 piculs of wet fish valued at M\$198,824.25 and 2,889 piculs 34 katis (1 kati = 0.6 Kg. approx.) of cured fish valued M\$54,269.77 during April-June. The following were the more important commodities handled by the Union for sale to members at preferential rates :—

Diesoline, 107,600	
liters	(23,670 Imp. gallons)
Petroleum, 500	
liters	(110 „ „)
Cylinder oil, 2,600	
liters	(570½ „ „)
Gear oil, 82	
liters	(18 „ „)
Grease, 110	
liters	(24 „ „)

The mechanical defect in the ice plant of a Co-operative Credit & Marketing Society, Malacca has been rectified and it is now able to produce a maximum capacity of 15 tons daily.

Marine Fisheries School:

The first batch of fishermen trainees since the opening of the Marine Fisheries

School, Glugor, completed their course on 9 June 1961. The results of the examination held were :—

	<u>No. Sat</u>	<u>No. Passed</u>
Engine Care & Maintenance	24	23
Engine Driver 3rd Class	23	19
Helmsmanship of a fishing boat	19	18

The new term began on 19 June and is being attended by 32 fishermen trainees from all parts of the Federation.

A new Fisheries School was started on 28 April, in Kuala Trengganu. It was officially opened on 2 May, and the first batch of fishermen trainees completed their course on 8th August 1961. The results of the examination were :—

	<u>No. Sat</u>	<u>No. Passed</u>
Engine Care and Maintenance	28	27
Engine Driver 3rd Class	16	16
Helmsman of Fishing Boat	16	10

The second course began on the 8. 9. 1961 and 22 trainees are attending.

The second five months course for the fishermen trainees in the Marine Fisheries School, Glugor, is well under way. The first phase of the course is almost completed. This includes engine care and maintenance, helmsmanship of fishing boats and lectures on cooperative principles, fish preservation and fishing methods in other countries. The major part of the second phase will consist of practical training at sea under the guidance of Colombo Plan Experts and visits to canning factories, ice plants and markets.

Fresh Water Fisheries:

A total of 171,959 fish fry consisting of Lampam Jawa, *Tilapia*, Lee Koh and Kalui were distributed during the period to various areas in the Federation.

A further 266 ponds covering 97 acres were opened up for fish cultivation, thus bringing up the acreage of fish ponds in the country to 1,418 acres. In addition, the Division treated a number of mining pools with piscicide. 68 mining pools and ponds covering 596 acres were stocked with fry for public fishing and for culture. Land is being acquired in Central Pahang for a new regional fry breeding station costing M\$86,000. This station will provide fry not only for pond-culturists in the South-East Region but also for the stocking of disused mining pools, swamp and rivers in the area.

During the quarter under review, the following fish culture courses were given :—

April 1961	7 trainees
May 1961	20 "
June 1961	27 "
July 1961	10 "
August 1961	10 "

Research:

(a) Cockle Culture

Special aspects of cockle biology initiated during last year were continued. Soil analysis of bottom muds from a number of culture and nature beds were completed. Spatfalls that were observed on the beds at Tanjong Tokong during April-June 1960 failed to occur in 1961. Only a few seed cockles were found after investigation. Attempts to rear the planktonic larvae of the cockle by employing a constant flow of fresh filtered sea water has yielded a few veliger larvae from artificial fertilized eggs, the growth rate

of other larvae has been improved under the new system.

(a) *Restrelliger* Fishery

Water samples for the physical and chemical analysis of sea-water at the *Rastrelliger* fishing grounds are still being collected to find a correlation between the water quality and the landings of the Kembong fish. The results of the analysis of sea-water samples collected since April 1959 are now being processed. The physical and chemical data include temperature, salinity, dissolved oxygen and phosphate content of the sea-water collected from the surface to a depth of 45.7 m. (25 fathoms) at 9.1 m. (5 fathoms) intervals. Plankton samples collected during the preceding two years have now been worked up.

(b) *Storage of Salt Fish at Low Temperature*

Work on the preservation of salt fish at low temperature is being continued at the Glugor Laboratory as well as in the

commercial cold room at Penang Road. Particular attention is being paid to the rate TVN bases are given off.

(d) *Salinity Studies on the Sea-water along that the East Coast*

Preparation for sampling of sea-water for salinity determination have been completed in collaboration with the Marine Police, Federation of Malaya. Regular sample from five points along the route of the police launches on the East coast as well as the Kedah and Langkawi coast are now being collected and sent to the Fisheries Laboratory at Glugor for analysis.

(e) *Fresh-water Prawns*

Research into fresh-water prawns (*Udang Galah*) was continued throughout the quarter under review. Special was laid on the rearing of young larvae and it has been possible to bring the young up to a juvenile stage. One batch of has already survived for more larvae than 3 months.

NEW GUINEA

The extract from Territory of New Guinea-Report for 1959-1960, Ch. 5. pp. 78-80, gives the following information on the fisheries of the Australian Trust Territory of New Guinea.

Administrative Organization: The Department of Agriculture, Stock and Fisheries is responsible for the administration of fishing activities through the Division of Fisheries.

Legislation: The fisheries law of the Territory, which provides for the protection and use of the fishing resources, the control and regulation of fishing by a licensing system, and the payment and collection of 'licence fees, is contained

mainly in the Fisheries Ordinance 1922-1938, the Pearl Fisheries Act 1952-1953 and the Fisheries Act 1952-1959 of the Commonwealth of Australia, and in the regulations made under this legislation. The export of fish and fish products is controlled under the Customs Ordinance 1951-1959 and the Commerce (Trade Descriptions) Ordinance 1952, and in the Export (Fish) Regulations 1953, made under these two Ordinances. Fish handling and processing are controlled under the Pure Foods Ordinance 1952-1957 and Regulations.

Resources

Territorial waters contain a great variety of fish species. Relatively few

are of importance as food and only a small number are harmful. In the estuaries and rivers eels, catfish, perch-like fish and barramundi are found, and during certain seasons, when the rivers are not too high, river mullet go upstream. On the shallow reefs parrot fish, wrasses and surgeon fish are plentiful. Deep offshore reefs contain paradise fish and many kinds of snapper and sweetlips, including a red bass and the emperor or government bream. Spanish mackerel, pike and tuna are often taken by towing lines. One particular species, the dogtooth tuna, is found almost exclusively in deep entrances to reefs. In the open sea yellow fin tuna sometimes abound and sailfish, dolphin fish and sharks are also seen. The narrow barred Spanish mackerel (*Scomberomorus commersonii*) frequent territorial waters throughout the year, but are concentrated in school of a commercial size only from August of November. Fish taken in commercial numbers by trolling are two species of the seapike or barracuda (*Sphyræna* sp.) and reef fish, mainly coral trout. Shell of *Trochus*, green snail, goldlip and other species of shell-fish are found in commercial quantities on most of the reefs.

Catch and Marketing:

Many of the coastal and island people are actively engaged in organized fishing and catches surplus to their subsistence requirements are normally used in barter trade with the hinterland people or sold at town markets. There is one commercial fishing venture based on Rabaul. With the use of better equipment and techniques catches are improving substantially and the quantity of fish being produced for cash sale by organized village groups is increasing. Shell fishing is almost entirely in the

hands of indigenous fishermen. The principal marine products exported are *trochus* shell and green gnail shell. Exports remained fairly constant. The beche-de-mer fishing has improved only slightly and has not, as was hoped, developed into a big industry.

Fisheries Development and Research:

During 1959-60, training of indigenous fishermen continued at a high level and direct assistance was given to a number of groups of fishermen in catching and marketing fish. Improved facilities and additional staff at the marine biological station being established at Kanudi, near Port Moresby, have permitted technical training to be continued at a high level and the standard of fishing gear being developed is improving rapidly. The main improvements are in the field of modern net designs being used with success in Australia, and in older techniques adaptable to the local fishing craft. The Kanudi station is being constructed in stages, the second of which will be completed in 1960-61. Two skilled European technical assistants are giving instruction in modern fishing techniques using cotton and synthetic netting materials. Further experiments in new designs of fish nets and traps are being continued with particular reference to local requirements.

Pond Fisheries: Although *Tilapia* introduced in 1954 are now contributing small amounts of protein to lowland areas, the introductions have not proved satisfactory in altitudes above 1524 m. There is evidence that *Tilapia* do not thrive even at moderate altitudes above 508 m. and varieties of temperate water fish which may be more suitable are being sought. Although the surface water temperatures at 1524 m. during the day can

simulate tropical conditions, the temperature of the bottom water, even in shallow ponds, probably seldom rises above 75°F. and at night falls below 60°F. Two new species of commercially important tropical fish, *Trichogaster pectoralis* and *Osphronemus gouramy*, have been imported and are now stocked in breeding ponds but, probably because of the predatory activities of *Gambusia affinis*, no fry have survived. Two species of carp, Cantonese and Singapore varieties, were introduced this year. Both are well established and have produced a few fry but they are not yet breeding on a sufficient scale to assure satisfactory propagation. The Cantonese variety is a small type which grows quickly to maturity. The Singapore carp at Dobel, Mount Hagen 1524 m. altitude grew to 900 g. in about a year and offer good promise of a high production at this altitude. Trout introduced into highland areas are reported to be doing well in the limited suitable water available, especially in streams at an altitude of not less than 2134 m. Investigations made up to 2505 m. and at Lakes Aunde and Peunde on Mt. Wilhem show that considerable quantities of animal food are available in some streams above 1829-2134 m. altitude and the selection of the correct type of predator for this altitude is being investigated. The temperature of the lakes is above 50°F. although the small streams filling them are below 50°F. Part of the problem in stocking is that the temperature of the larger rivers on the highland plateau at 1524 m. often exceeds 80°F. and in this transitional zone the fauna are not well developed.

Preservation. Experiments to improve the standards of fish preservation are continuing. Dried and smoke-preserved fish are most popular.

Check List of Fishes. A check list of the fishes of Papua and New Guinea has been published in the Papua and New Guinea Agricultural Journal. This list has been compiled on a geographical basis and incorporates all fish records of Papua and New Guinea, Netherlands New Guinea and the British Solomon Islands Protectorate. A handbook covering the same area is in course of preparation and will be published in two volumes.

Training. Eight fishery assistants from the Territory are being trained by the Fisheries Division. Training covers a minimum period of three years and involves a study of fish and shell species together with the problems of river, estuary and reef fishing, the construction and repair of different types of fishing gear, seamanship and fishing operations. Those who pass their examinations are given the opportunity to proceed to more complex training leading to qualifications which will enable them to give instruction in villages on fishing methods and the preparation of fish for market, to take charge of station and field work, to design and operate new gear and to manage fisheries vessels up to 18.3 m. (60 f.) in length. Depending on the qualifications they obtain, the assistants will be stationed at various places in the Territory where they can best assist local fishermen, or will be attached to technical personnel for survey work. Two fishery assistants have recently qualified for the position of fishery fieldworker and carrying out fisheries work on the coast between Wewak and Lae.

Shrimp Fishery.

Shrimp from New Guinea could meet the challenge of cheap imports from Asia and provide new outlets for Australian investment. This is the opinion of an experienced fisherman and now a fish

wholesaler and exporter of South Brisbane, Australia. The former fisherman was commissioned by the Australian Department of Territories to conduct a survey of fisheries resources in southern New Guinea waters. There is a terrific potential for shrimp in the area. With its low labour costs, New Guinea could easily compete with shrimp imports from other cheap production countries. The waters of southern New Guinea—particularly toward Orangerie Bay and Mullins Harbour, are capable for large-scale exploitation. However, a capital outlay of about £100,000 (US\$223,800) would be needed to establish the industry. After fitting up the fisheries research vessel TAGULA for shrimp fishing, an Australian master fisherman made several surveys during his six months' appointment. He found: (1) a large variety of shrimp, chiefly king, greasy backs, banana, and tiger, but no school shrimp; (2) a big bed of scallops about 96 km. northwest of Port Mo-

resby; (3) plenty of spiny lobsters off Yule Island; (4) large quantities of shrimp existed in the Daru area (Gulf of Papua); (5) a prolific fishing ground, chiefly for barramundi, along a 96 km. stretch of sunken reef in the Louisiade Archipelago; and (6) big numbers of dugong (sea cows) from which is extracted oil for the watchmaking and instrument trade. He said the survey proved that the painted spiny lobster is a vegetarian and cannot be caught in traps. Catching will probably be restricted to hand capture—as at present. There is a possibility that trawling could be used on the outside shallow edges of reefs or perhaps gill-netting. Shrimp were most prolific after the wet season.

A mackerel survey along the Louisiade Archipelago showed that in the first six days, approximately 3,570 kg. of fish were caught, which showed the great potential development. (*Fish Trades Review*, February 1961).

NORTH BORNEO

Shrimp Resources

A Kagawa Prefecture firm, in Shikoku, Japan has sent four vessels—the KAGAWA MARU No. 1, 215 tons, and KAGAWA MARU No. 2, 75 tons, and two trawlers of the 40-ton class from Takamatsu, Kagawa Prefecture, to Sandakan (located in the northeastern section of North Borneo on the Sulu Sea), to explore the

shrimp-fishing potential in that area. The contract on the fishing vessels can be renewed at the end of three months, but whether or not a joint company may be established depends upon the results of the exploratory fishing. Besides the Kagawa Prefecture firm, two other Japanese fishery firms are also participating in the enterprise.

PAKISTAN

The Quarterly Progress Report of the Central Fisheries Department for the period ending 30 June 1961 gives the following information:

Karachi Fish Harbour and Market:

With the exception of fish curing yards, slipway and workshop, the entire

Karachi fish harbour project is now complete. During the period under report, Karachi Wholesale Fish Market handled 8,951.9 tons, of fresh, dry, wet salted and cured fish valued at Rs. 49,80,170.52. This shows an increase of quantity by 388.9 tons and a decrease of value by Rs.

9,11,544.48, as compared to the previous quarter. The status of fresh fish distribution is same as before.

Fisheries Developments in West Pakistan:

During the period under report the departmental vessel M.F.V. MACHHERA and NEW HOPE have been engaged in Sea exploratory operation. MACHHERA made 15 trips, caught 1,915 Kg. of fish and shrimps valued at Rs. 1,688.54, while NEW HOPE made 15 trips, caught 515 Kg. of fish and shrimps, valued at Rs. 398.64. Thus both the vessels made a total 30 trips, caught 2,430 Kg. of fish and shrimps valued at a total sum of Rs. 2,087.18. This shows a slight decrease in the number of trips by six and a handsome increase of catches by 544 Kg. and of value by Rs. 837.92 as compared to the previous quarter. Despite the rough condition at sea, the vessels operated on Sind and Karachi coast, and conducted fishing between 18.3 to 27.4 m. continuous in the unexplored areas.

Later on the fishing operations of the vessels were suspended due to the on set of monsoon condition.

The work list of both the vessels, have been sent to various ship building and repairing firms, for the dry docking and giving estimates of repairs. At present the annual refit and overhauling of the vessels is in progress.

Oysters were collected from the artificial oyster beds off Wagadar, Noor Khan and Kathore, to study the maturity of gonads. A survey of oyster beds was also made during the month of May, off Korangi and adjacent creeks to assess the population increased, therein. Towards the end of the present quarter, resetting of the oyster beds off Wagadar and Noor Khan, and study of maturity of gonads, have been completed.

Fishing Requirements:

Two Marine Diesel Engines (one of 10 h.p. and the other of 40 h.p.) were issued to the fishermen through the fishermen's Society in the beginning of the quarter. All the 95 inboard engines allotted for Karachi area have been issued to the fishermen through the Karachi Fishermen's Cooperative (P & S) Society Ltd., Karachi, except one 90 h.p. engine which has been allotted to the Zoological Survey Department, Karachi.

The following fishing articles have been sold by the Karachi Fishermen's Cooperative (P & S) Society Ltd., Karachi:—

1. Nylon Twine	Rs. 2,19,935.91
2. Teak wood	Rs. 33,524.70
3. Coir Ropes	Rs. 50,180.92
4. Floats	Rs. 22,982.64
5. Spare parts (Govt.)	Rs. 3,282.23
6. Mast wood	Rs. 7,324.00

The following recoveries have been made during the quarter.

1. Nylon Twine (old)	Rs. 4,165.00
2. Nylon Twine (new)	Rs. 56,894.80
3. Marine Diesel Engines	Rs. 11,536.75

Fisheries Development in Mekran Coast:

(a) Mekran Coast Fisheries Development Scheme: The fish carrier vessels under construction are expected to be completed very shortly. The construction of Ice Plant, Cold Storage Building and staff quarters is in progress. The cold storage machinery has arrived.

(b) Modernization of Fish Curing yards at Pasni and Gwadar: The salting and store rooms have been completed, carpetin of the court yards and setting of drying rack is in progress. Construction has been completed upto plinth level

and further construction is in progress at Gwadur.

(c) Mechanized Fishing Scheme in Mekran Coast: All the 10 launches have been completed and their delivery taken. Nylon twine and coir ropes have been obtained from the Society, for preparing nets. Order for making nets will be placed shortly.

Fisheries Development in East Pakistan:

(a) Exploratory Fishing: A research vessel is under construction at Karachi Shipyard. First installment of Rs. 2,08,000.00 has already been paid to the firm for the construction of this vessel.

(b) Technological and Biological Station at Chittagong: The Chittagong Development Authority has allotted 0.80 hectares of land for the construction of the station. The cost of the land in question is at the rate of approximately Rs. 185,000 per hectare as fixed by the Government.

(c) Fish Harbour at Chittagong: The Chairman of the Chittagong Port Trust has been requested to hand over the possession of the land of the proposed Fish Harbour. Mr. Saito, Harbour Engineer under Colombo Plant has prepared a design of the proposed Fish Harbour at Chittagong.

(d) Mechanization of Fishing Fleet in the Bay of Bengal: 85% of the construction work of the 12 boats has been completed. It is expected that the construction of the boats will be completed within the stipulated time. Two boats of Khulna Fish Preservation and Marketing Corporation are now engaged in fishing and fish carrying operations in the Khulna estuaries. Some of the other boats are

carrying fish in Chittagong, Cox's Bazar, and Khulna areas.

(e) Fish Market at Chittagong: Construction of Fish Market Building has been completed but the machineries for Ice Plant and cold storage have not yet been received.

Miscellaneous:

(a) Preservation and marketing of fish: The dry and fresh fish markets of Chittagong Municipality were visited to examine the quality sold there. Fish curers and dry fish dealer, were advised regarding different problems of fish processing, transport and storage.

Officers of Central Fisheries Department are busy in relief and rehabilitation work of the cyclone effected fishermen of East Pakistan.

Development Note on Warsak, Kaghan, Swat and Chitral:

(a) Warsak

1,32,000 fry/young fish have been stocked in ponds and tanks. In area 'O' of Warsak there was a big area under water out of which a small isolated portion has been converted into a Nursery in which the fry/young fish have been introduced 7,000 fingerlings were netted and stocked into the main Dam. The river Kabul was surveyed upto 12.8 Km. upstream the Dam. There are very few fish in the main stream.

(b) Kaghan

For the first time Lulsar Lake was stocked with adult Trout in hope that they would breed naturally there. In addition 553 fry were stocked in stream. Stripping of Trout which was started on 20 December 1960 continued during the period under review and more than 50 thousand eggs were taken from 211 females. 211 Fishing Licences were issued

and Rs. 2,500 were realized as income on account of fishing licences. Two exhibitions were maintained, viz., at Naran and Shinu.

(c) Swat State

The staff has been appointed at the end of November 1960, and spade work is being done by the Trout Development Officer.

(d) Chitral State

An extensive survey of the Chitral river, Kutukh, Mustuj, Remah and Rembosat streams was carried out. Five species of fish are commonly found there, i.e. *Glyptosternum reticulatum*, *Shizothorax exocinna*, *Namachilus chorrai* and *Oreinus sinuatus*.

Brown Trout is also found in certain parts of the Chitral River. The waters of Chitral are found suitable for propagation of Trout Culture from physiological and biological points of view.

Government development activities in East Pakistan include the establishment of a Fisheries Training Centre, the first of its kind in this wing. Construction of buildings has started and the first class, consisting of 8 undergraduates and 4 graduate trainees, has been enrolled. Further constructional work includes the building, in the near future, of the Fis-

heries Technological Laboratory and the construction of floating Fish Landing Jetties with shore facilities for packing, icing and cold storage. One such jetty has been constructed at Khulnaghat and 3 more are planned for the near future. The mechanization of fishing craft is continuing and 19 vessels, 10 of which are for fishing, have been built according to designs prepared by FAO. The program includes the construction of a further 48 fishing and fish-carrying vessels during the period 1962-63.

In an effort to bring under control the derelict tanks, the program of the Fisheries Extension Service has been expanded and the approach to the people includes a program for disseminating fisheries information by means of rural folk songs. The vocational training centres for fishermen are to be developed progressively and it is anticipated that four such centres demonstrating the use of more effective fishing gear and the operation of mechanised boats will be established during 1961-62. The research program includes studies on the control of aquatic vegetation, prawn culture, pond fertilization, control of predators and of parasites and fish diseases in inland waters, together with investigations on the freshwater mussel, with a view to increasing the production of pink pearls.

PHILIPPINES

A good number of the staff of the Fisheries Research Division have been awarded fellowships under existing training programmes of the United Kingdom and Japan under the Colombo Plan and of the Federal Republic of West Germany.

Mr. Adriano Atencio, Junior Fishery Technologist, is currently training on water pollution and toxicology at the University of Freiburg, Germany.

Mr. Rodolfo Estacio, Junior Fishery Technologist, who left for London February 21, 1961, is undergoing training in the study of benthose and population studies at the Windermere Laboratory of the Freshwater Biological Association.

Miss Lydia Salcedo, Senior Fishery Technologist, and Miss Emilliana Fajardo, Junior Fishery Technologist, left together for London on March 13. Miss Salcedo is

now undergoing advanced training in water pollution studies at the Windermere Laboratory of the Freshwater Biological Association. Miss Fajardo is training in Planktonology under the auspices of the University of Glasgow.

On 2 June 1961 a group of five composed of Mrs. Regina S.J. Napugan, Misses Natividad Macalincag and Gloria Guevara and Messrs. Dominador L. Galvez and Felix R. Gonzales left for Tokyo to undergo training on the different phases of research on marine products processing and chemistry of fish at the Tokai Fisheries Research Laboratory.

Fishery consciousness is growing among the people. In a brief span of four years from 1957 to 1961, the number of fishery schools in the country had increased from seven to 28. Establishment of secondary fishery schools was in response to the clamor of provincial and municipal governments and inhabitants of fishing communities for the opening of such schools. These fishery schools located in different parts of the archipelago are being administered by the Bureau of

Public Schools pursuant to government reorganization plan No. 30-A which took effect on 16 January 1957. The Fisheries Bureau which formerly administered the fishery schools renders technical assistance to these institutions. Four of five new secondary fishery schools might be set up during the present academic year. Prior to World War II, most Filipino fishermen, fishing boat operators and fishpond owners never thought it necessary to acquire technical knowledge and training in fisheries technology as they were contented with the use of primitive methods of fishing.

Negotiations for the establishment of the first private scholarship in the U.P. College of Fisheries are being finalized between a fishing magnate, the Department of Marine Fisheries, College of Fisheries and University of the Philippines. Two scholarships, one in the two and a half years curriculum and the other in the 4-year curriculum, will each carry an annual stipend of 2,000. The basis of selection will be by competitive examinations and final choice will rest on the donor.

TAIWAN

Fisheries Landing in 1960:

The 1960 fishery landings in Taiwan of 259,140 metric tons again surpass the previous record in 1959. The most significant increase took place in the deep-sea fisheries. The decline in landings from coastal fisheries is due to a drop in the number of boats without power, which are included in this category. Fish culture production showed a slight increase in spite of the floods caused by the 1 August typhoon, which damaged many fish ponds. The target for 1960 was 255,000 metric tons and that for 1961 has been set at 270,000 tons.

Tuna Vessels:

The construction of two 550-ton tuna long-liners is taking place in a Japanese shipyard. The vessels will be used for tuna fishing in the Indian and Atlantic Ocean.

Chemical Fertilizers:

Over 3,000 tons of ammonium sulphate and calcium superphosphate were used in milkfish ponds in 1960. Chemical fertilizers have become increasingly popular with fish farmers in Taiwan due to their lower cost and more rapid action as compared with organic fertilizers. It is estimated that about 5,000 metric tons will be required for 1961. (*Comm. Fish. Rev.*, April 1961).

THAILAND

Thailand's commercial fresh-water fish production, which has been holding steady at about 50,000 metric tons a year through 1958, rose to 60,000 tons in 1959. All was used for home consumption. The total salt-water catch in 1959 was 150,000 tons, of which about 10 percent was exported, mostly as cured fish to Indonesia. The commercial catch of Pla-thu ("Rastrelliger" species), the common daily food of the poorer classes, is estimated at 50,000 tons a year. In addition to the commercial marine catch, there is a substantial catch by anglers for their own direct consumption.

In 1958, Thailand had a fishing fleet of about 2,200 boats with a total tonnage of 22,000 tons. The marine catch landed

at Bangkok in recent years has been estimated at from 30,000 to 40,000 tons annually.

In addition to finfish, shrimp production has gained importance, particularly since the semigovernmental Cold Storage Organization has been providing cold-storage facilities at the port of Bangkok. The United States has become the largest customer for Thai shrimp since the first shipment to that country in April 1959. The 1959 United States imports of frozen shrimp from Thailand amounted to 176,000 pounds valued at \$180,000. Through April 1960, Thai shipments amounted to 220,000 pounds. (*Comm. Fish. Rev.*, July 1961)

U.S.A.

President Kennedy has asked Congress for 97½ million dollars, for the fiscal year 1962, for a national oceanographic program. The total includes 37 million dollars to build 10 oceanographic ships, and is nearly double the 1961 estimate. Only two of the proposed new ships will replace existing vessels. The present US oceanographic fleet comprises 27 research ships and 17 survey vessels. All but two of them were built before the war, and only two were designed specifically for research. The President's oceanographic programme also provides for training oceanographers and for international co-operation. On the latter he said:

"Systematic surveys and research in all the oceans of the world represent tasks of such formidable magnitude that international sharing of work is a necessity. Present maps of the oceans are comparable in accuracy and detail to maps of the land areas of the earth in the early part

of the 18th century. Precise methods of measuring ocean depths have become available during the last ten years, and these, when combined with new developments in navigation, should make possible for the first time modern maps of the topography of the entire sea floor. This year an Intergovernmental Oceanographic Commission is being established under UNESCO to provide a means whereby interested countries can co-operate in research and in making surveys and maps of the deep sea floor, the ocean waters, and their contained organisms. Membership of the Commission is open to all countries of the UN family that desire to co-operate in oceanography. The United States intends to participate fully in the activities of the Commission. The United States also will participate in the International Indian Ocean Expedition. Many nations, including the Soviet Union, are co-operating in this expedition under the

non-governmental sponsorship of the International Council of Scientific Unions. Over a quarter of the world's people live in the countries surrounding the Indian Ocean. If more can be learned of the Indian Ocean's extensive food resources, these nations can be helped to develop and expand their fishing industries as part of their general economic development."

A contract for one of the first research ships to be built under the oceanographic programme was already awarded. The contract is for 1,773,948 dollars. The vessel, which will be the first stern trawler built in USA, will be 57 m., with 10 m. beam, speed of 12 knots and range of 9,000 miles. Complement will be 16 scientists and 25 crew. Construction time is estimated at 15 months. A U.S. Coast and Geodetic Survey ship, the 94.8 m. PIONEER, was to leave San Francisco in April to begin the systematic study of 3 million square miles of ocean between the Hawaiian and Aleutian Islands. Operating out of Alaska and Hawaii, the PIONEER, will navigate along a series of north-south lines spaced 10 miles apart across an area about 300 miles wide and 2,000 miles long. The first line is planned to follow a course 10 miles east of the 158th meridian, commencing at a point just south of the Alaska peninsula and extending southward to the Island of Oahu, Hawaii. Subsequent lines will move eastward during the 1961 season. The project ultimately will extend from the Hawaiian Archipelago to the Aleutian Islands and from the 153rd meridian westward to the 180th meridian. PIONEER is fitted with Loran C positioning equipment for control purposes. Anticipated range

of this system is 1,500 nautical miles for ground waves and 3,000 nautical miles for sky waves. Accuracy position is reported to be 1,000 feet at 1,000 miles using ground waves. Loran C Stations in the Hawaiian Islands are not yet operational. Work during the first part of the season will be limited to that area effectively covered by the Aleutian Loran C control system. The first phase of the survey will include a continuous profile of the ocean bottom obtained with a precision depth recorder, a continuous profile of the total magnetic field made by a towed Varion Proton Magnetometer, regular gravity observations by a La Coste-Romberg gravity meter, regular meteorological balloon releases, and a sea-water temperature observation every two hours.

Additional observations at predetermined locations will be made during the second phase of the programme beginning in September. At these locations bottle casts will be made for temperature, salinity, dissolved oxygen, and such other variables as the cooperating agencies may wish to measure. Sediment cores will be made at each station, and the U.S. Geological Survey will process this sediment data. Plankton tows are planned with the U.S. Bureau of Commercial Fisheries supplying biologists and equipment. Current measurements are planned in the Alaska Boundary Current. These oceanographic observations will be spaced along a course north from the Hawaiian Islands to the Aleutian French, west along the axis of the trench to turn south in the area of Adak, and proceeding past Midway Island to 23 degrees 30 minutes north, thence east to Hawaii. (*Fisheries Newsletter*, July 1961)

VIETNAM

Major achievements in fisheries development during 1961 included the development of new export markets, the discovery of large schools of threadfin (*Polynemus*) and the initiation of the survey of the nation's fisheries resources. A large concentration of threadfin was discovered to the north of Cap St. Jacques and there is reason to believe that this discovery may indicate the presence of considerable schools further north.

Technological studies have resulted in the development of a method of redu-

cing nuoc mam to solid form and the production of high quality agar-agar from a blend of 5 types of sea-weeds found in the coastal waters of Central Vietnam. Approximately 300 specially adapted engines were distributed in the program of motorization of the Vietnamese bamboo-bottom fishing junks. A complete listing of the types of commercial fish commonly found in Vietnam identifying the fish by scientific, Vietnamese and commercial names has been prepared. (*Com. Fish. Rev.*, August 1961).

FAO ACTIVITIES

Staff Movements

Mr. W.H. Cummings, the Regional Representative, FAO Regional Office for Asia and Far East, Bangkok, during 1949-61, left Bangkok on 10 July 1961 to take up the post of UNTAB Resident Representative in Burma, Rangoon. Mr. Cummings is an agricultural expert and a specialist in rice production. He has spent several years in Burma as technical adviser and has also worked in other Far Eastern countries. He joined FAO in 1947 and was appointed as the first FAO Regional Representative for Asia and Far East in 1949.

Mr. Thet Su, the former Deputy Regional Representative has taken over as Acting FAO Regional Representative in Asia and Far East. Mr. M. Ohto, formerly at FAO Headquarters, has been appointed Acting Deputy Regional Representative.

Technical Assistance

Mr. P. Lusyne and **Mr. Gilles** have set up a training center for fishermen in Vietnam. The center is for the duration of six months and it is expected that other

permanent training centers based on the above will be set up in Vietnam in the near future.

Mr. Igor de Garine, winner of the French Liotard prize for his anthropological work among the African Masai, will return to Africa on his second assignment for the FAO. Mr. de Garine, seconded by FAO from the French National Centre for Scientific Research, Paris, will be on a three-month assignment in Senegal to make a study of the possibilities of increased fish consumption there and its bearing on social and cultural patterns. Mr. de Garine previously did a six-month survey as an FAO consultant on the food habits of the Serere and Wolof tribes of Khombole, Senegal. The French expert accepted the French Liotard prize — a check for 1,000 NF and a statuette representing the Concourt prize for exploration — from French President Charles de Gaulle. The award, given to Mr. de Garine in the presence of the president of the French Explorers Society, the director of the French Natural Science Museum and other officials, was for the year and a half

the French anthropologist spent living with the Massai in the Republique de Cameroon in order to study their economic system for the International African Institute. This study tour among the Massai preceded his first FAO assignment. Mr. de Garine will join two other FAO experts in Senegal: Mr. John Fridthjof, a Danish nutrition officer and Mr. Jean Mocquard, a French food technologist. Mr. Fridthjof is preparing to launch a campaign there, in co-operation with the Senegalese government, for the consumption and commercial distribution of locally produced protein-rich foods, such as groundnut

flour. Mr. Mocquard is concerned with the development, manufacturing, packaging, storage, transportation and distribution of protein-rich food products.

Mr. Albert Sutherland (U.K.) has taken up a one-year assignment as FAO/TA Marine Engineer, stationed in Cochin, India, beginning December, 1961.

Mr. Sutherland's task is to organize a special Engine Section at the Central Government Fisheries Technological Research Institute of India which will study the servicing and maintenance of engines in local fishing boats.

IPFC AFFAIRS

The following changes have taken place in the Member Governments' nomination to the Council's Committees.

Mr. Vernon Brock (U.S.A.) formerly Area Director of the Hawaii Area of the U.S. Bureau of Commercial Fisheries has been transferred to Washington, D.C. and **Mr. J.C. Marr** who has succeeded Mr. Brock as Area Director has now been appointed as the IPFC Administrative Correspondent.

Mr. Noriaki Oka has transferred to the post of Chief, Fisheries Statistics Section, Statistics and Survey Division of the Ministry of Agriculture and Forestry. **Mr. Tsunezo Kitahara** has succeeded Mr. Oka as the Chief, Statistics and Data Section, Research Division, Fisheries Agency, Ministry of Agriculture & Forestry. Mr. Kitahara has also succeeded Mr. Oka as the member of the IPFC Technical Committee II. Mr. Oka remains a member of Panel C of Technical Committee II and of the Fish Marketing Sub-Committee.

Mr. J.A. Tubb, Secretary, IPFC, visited New Guinea during June/July 1961 and reviewed developments in fish culture and Technical Assistance programs. **Dr. G.N. Subba Rao** visited Ceylon, India, East Pakistan and Burma to establish contacts with fisheries workers in these countries and to discuss technical assistance and U.N. Special Fund programs.

The following circulars were sent to IPFC Administrative Correspondents and Technical Committees members.

IPFC/Circ. 61/1 — Corrections of "Symposium on Zooplankton Production".

IPFC/Circ. 64/2 — Publication of the Fisheries Research Board of Canada Bulletin No. 122, 1960 entitled "Measuring the Production of Marine Phytoplankton".

IPFC/Circ. 61/3 — A copy of the Proceedings of an International Economic Conference on Small Craft for Fisheries and Transportation, New York.

IPFC/Circ. 61/4 — Information for IPFC Current Affairs Bulletin.

IPFC/Circ. 61/5 — International Indian Ocean Expedition.

IPFC/Circ. 61/6 — Proposed Handbook on Fishing Boat Design.

IPFC/Circ. 61/7 — Drying of Fish.

IPFC/Circ. 61/8 — Country Statements for the FAO International Conference on Fish in Nutrition,

IPEC/Circ. 61/9 — Fishery Seminar and Study Tour in the USSR.

IPFC/Circ. 61/10 — Fish Containers.

IPFC/Circ. 61/11 — Certain Changes in the Membership of IPFC appointments of the Government of Thailand.

IPFC/Circ. 61/12 — IPFC Administrative Correspondents.

PERSONALIA

Advice has been received that **Dr. Tham Ah Kow**, formerly Director, Department of Primary Production, Ministry of National Development, Singapore, has retired from Government service following illness.

Dr. Tham is still serving, however, as a part-time consultant with the Singapore Government. **Mr. Cheng Tong Fatt** who until recently was Acting Director, has been appointed Director of Primary Production.

Dr. Tham, a strong supporter of the IPFC, has served as member of Technical Committee I & II, the Special Sub-Committee on Rastrelliger, and as Vice-Chairman (1957-1958). He has contributed several valuable papers to the Council's Sessions.

Vernon E. Brock, well known in Hawaii's scientific and fishery circles, left the Islands on July 15 to assume new duties as Director of the Bureau of Commercial Fisheries Biological Laboratory in Washington, D.C. Until his departure he was Director of the Hawaii Area of the Bureau of Commercial Fisheries. Mr. Brock came to Hawaii in August 1944 to head the Division of Fish and Game in the Territorial Board of Agriculture and

Forestry. In February 1958 he joined the U.S. Fish and Wildlife Service as Assistant Director of the Pacific Oceanic Fishery Investigations, and one year later he was appointed Hawaii Area Director. He was President of the Hawaiian Academy of Science in 1959-60, and served as an affiliate member of the Graduate Faculty of the University of Hawaii. An enthusiastic skin-diver and spear fisherman, Brock pioneered in the application of underwater research techniques to the study of Hawaii's inshore fishes. His special field of interest, the biology of the tunas, fitted well into the Hawaiian commercial fishing scene, which is dominated by tuna fishing, but he found time to become familiar with Hawaii's myriad species of reef fish and to co-author, with Prof. William A. Gosline, "A Handbook of Hawaiian Fishes". Brock's work during his years in Hawaii took him to many parts of the central and western Pacific, and he was always on the lookout for opportunities to collect and introduce useful aquatic animals into Hawaii's salt and fresh waters. In his new post Mr. Brock will be directing new programs of biological and oceanographic research in the tropical Atlantic Ocean where the

tuna fisheries are developing rapidly and becoming of increasing importance to the American tuna industry. He will also be concerned with the expanding oceanographic research programs of the Bureau of Commercial Fisheries and the coordination of those programs with ocean research by other agencies.

Mr. Jose Domantay, formerly Chief of the Inland Fisheries Division, has been appointed the Assistant Director, Bureau of Fisheries, Philippines, succeeded Mr. J.R. Montilla who has taken over as the Director. **Mr. Guillermin J. Blanco** has been designated as the Acting Chief of the Inland Fisheries Division.

Mr. Hubertus van Pel, who has been working as a Fisheries Officer in the South Pacific Commission since July 1954, has retired on account of ill health. Mr. van Pel introduced improved methods of catching, processing and marketing of fish in the SPC area and he was also largely responsible for introducing fish farming. Fingerlings of the hardy, fast-multiplying *Tilapia mossambica* were introduced in many artificial ponds and lakes in various parts covered by the SPC. Mr. van Pel was the Director of the first FAO-SPC Fisheries Training Centre which was held during 1956-57 for 25 trainees from 14 territories of the SPC. He also had the main responsibility for the FAO-SPC boat-building training course at Auki in the Solomon Islands and also the second Fisheries Training Centre which opened in 23 August 1961 at Tulagi in the Solomon Islands. Mr. van Pel developed the basic design of the 25 ft. fishing

cutter, of which three are being built at the boat-building school of the fisheries training centre.

M. Michel J. Angot formerly Marine Biologist in the Office de la Recherche Scientifique et Technique d'outre-Mer, stationed at Institut Francais d'Océanie, Noumea, New Caledonia, has been appointed Director, Marine Station, B.P. 68, Nossi Be, Republique Malgache, Madagascar. M. Angot left Noumea on 14 September 1961 to take up his new assignment.

Mr. Sant Bandhukul, formerly Senior Fisheries Officer of the Department of Fisheries, Thailand, was appointed Deputy Director-General of Fisheries for Thailand with effect from September 1961.

Mr. Sant has served for some years as Member of Panel B, Technical Committee II, IPFC, and has taken an active part since its formation in the work of the Special Sub-Committee on Rastrelliger.

Mr. Suchit Bhinyoying, Fisheries Research Officer and **Mr. Prasit Agura**, Chief, Chaophya Fisheries Station, both of the Fisheries Department of Thailand, have each been granted 3-month fellowship to study in the field of fish culture under the guidance of Dr. S.W. Ling, FAO Expert in the Federation of Malaya.

Mr. Suchit and Mr. Prasit left Bangkok to take up their study course in November 1961.

Mr. S.A. Jaleel, Assistant Director, Central Fisheries Department, Karachi, was promoted to the post of Deputy Director, (Fish harbour) Central Fisheries Department in October 1961.

MEETINGS AND CONFERENCES

Biology of Tunas:

Arrangements are now well in train for the World Scientific Meeting on the Biology of Tunas and Related Species to be held at La Jolla, California, U.S.A., from 2-14 July 1962. This meeting is one organised following the recognition by the FAO Conference in October 1959 of the value of holding expert meetings on various species of fish. This Conference recorded the view that the world Scientific Meeting on the Biology of Sardines and Related Species held in Rome September 1959 had been timely and valuable and recommended that further such meetings be convened including specifically one dealing with Tunas.

FAO therefore decided to convene a meeting to cover, in the first instance, the biological aspects of Tunas stocks and at a later date there should be a further meeting to discuss economic and technological aspects of tuna fisheries. Member Governments of FAO of the United Nations or of other specialized agencies of the UN and certain institutions and individuals known to have an active interest in the subject have been invited to participate.

The organization of the meeting is being developed by FAO with the assistance of a consultative group including outstanding scientists from U.S.A., Europe and Asia. FAO will cover the costs of the Technical Secretaries and administrative assistance including editing, duplication and distribution of documents and translations before the meeting, together with interpretation services in the three FAO official languages during the meeting. FAO will also be responsible for the eventual publication of the reports and proceedings of the meeting using the xerox

process. The Host Government, USA, will cover the costs of the liaison officer, editing, duplication and translation of the documents during the meeting; interpretation in languages other than the FAO official languages; will provide Conference and office space including interpretation equipment, the necessary secretarial help and the facilities for any field trips which may be included in the program. Participants will be responsible for their travel to and from the Meeting and for their lodging expenses.

The Prospectus for the meeting has recently been issued by FAO and covers the organization of the meeting, objectives, scope and operations as well as details of the overall plan. Correspondence concerning the meeting should be addressed to Mr. Maracio Rosa, Jr., Technical Secretary, World Scientific Meeting on the Biology of Tunas and Related Species, Fisheries Division, FAO of the United Nations, Viale delle Terme di Caracalla, Rome, Italy.

Pacific Tuna Biology:

An informal conference, arranged by the U.S. Bureau of Commercial Fisheries Honolulu Laboratory, was held at the University of Hawaii, August 14-19. It was attended by 79 individuals, including 40 from over-seas. In addition to the continental United States, the over-seas participants were from Australia, Canada, Ecuador, Hong Kong, Italy (FAO), Japan, New Caledonia, New Guinea, New Zealand and the Philippines.

Virtually, all of the 50 contributed papers were reproduced and distributed in advance of the Conference. No papers were presented at the Conference. They were grouped by subject matter in the following categories: (1) Taxonomy and

Nomenclature, (2) Distribution, (3) Migrations, (4) Behavior, (5) Subpopulations, (6) Tuna Oceanography, and (7) Background Papers. Half-day discussions were held on each category (except 7). Each discussion group was provided with a discussion leader and rapporteur. Summary reports of the discussions were available on the day following.

Recommendations of the Conference arose during the course of the discussions and from two working groups (one on Taxonomy and Nomenclature, the other on Identification of Larval and Juvenile Tunas). Of the 15 recommendations of the Conference, 4 were concerned with the subpopulation or racial problem. The Bureau's Honolulu Laboratory was requested to establish a World Center for the exchange of tuna red blood cells and reagents used in identifying tuna blood groups (which are being used to identify subpopulations). Examples of problems to be attacked by tagging experiments or blood group studies included (1) do small southern bluefin south of Australia subsequently enter the fisheries to the west and northwest of Australia?, (2) what are the movements of small North Pacific albacore up to the time they enter the fishery? and (3) do the small-medium albacore found off the west coast of South America eventually enter the fishery of the tropical South Pacific? The importance of improving methods of transporting and storing blood samples was recognized. Additional studies of how much mixing must take place between subpopulations before they are no longer "independent" were urged.

Other recommendations dealt with taxonomy and nomenclature, assessment of year-class size of North Pacific albacore, international cooperation and exchange

of scientists between laboratories, and the need to assess the magnitude of the world tuna resource and the potential sustained yield of tuna.

It is planned that the recommendations, together with abstracts of submitted papers and summary reports of the discussions, be published in the near future.

Field trips included (1) a one-day demonstration cruise on the *Charles H. Gilbert*, (2) an open house at the Laboratory and (3) a visit to Bureau facilities, a tuna cannery and a marine aquarium, all at Kewalo Basin in Honolulu: US. F & WS News Notes, August 1961).

Fisheries Training Center for Melanesians

A 10-week training centre to instruct Melanesian fishermen in the operation of improved fishing gear and mechanized fishing craft was held beginning 23 August in Tulagi, British Solomon Islands Protectorate. The Centre was sponsored jointly by the FAO and the South Pacific Commission. The South Pacific Commission, representing the governments of Australia, France, the Netherlands, New Zealand, the United Kingdom and the United States of America, administers the South Sea Islands Territories.

Fishing is an important activity for subsistence in an island economy. The soil is limited on coral atolls and with increasing island populations the Melanesians have to turn even more to the sea for food. The inshore reefs and lagoons are generally overfished. The island fisherman lacks the proper equipment and the training for fishing in deep water, where mechanized boats are needed. The training centre was conducted on a practical level and included a maximum

of training at sea under commercial fishing conditions. It was intended for island fishermen from the Melanesian archipelago. Director of the centre was a South Pacific Commission fisheries officer in Noumea, New Caledonia. Assistant director was Mr. Pierre Lusyne, of the FAO in fishing gear section. The training centre Tulagi was the second such centre held this year by FAO's fishing gear section. The other centre was held in Viet Nam.

FAO Meeting on Research Vessels

Testing for radioactive waste, the possibility of using ocean going catamarans or twin hull craft for marine research, the Japanese development of a ship that causes no waves, these and many more advanced ideas was explored at FAO sponsored forum on research vessels, 18-30 September in Tokyo, Japan.

The modern fisheries research vessel more and more has become a floating laboratory, designed to do on the spot tests and, in some cases, pass on the information to a waiting fishing fleet. But even in a land-locked laboratory, where does one put water samples of a half ton each? Such huge water samples are needed to test for radioactivity, for the days are gone when a scientist simply lowered a string of small bottles over the ship's side and brought up water from different depths to determine the kind of plankton or the water's chemical content. Now, in this atomic age, scientists must test the oceans for radioactive waste, and since this waste diffuses, the water samples have grown from a quart to a half ton. But still the problem remains—how to process it?

The meeting's purpose was to compile and exchange new information on the region and operation of research vessels and to bring together oceanographers,

biologists and naval architects to discuss mutual problems and accomplishments.

The men involved in developing these new ideas were present at the forum, men like Prof. Takao Inui of the University of Tokyo whose particular project has been creating a ship that causes no waves.

It is known that a bulbous bow will reduce wave resistance, said Mr. Jan-Olaf Traung, chief of FAO's Fishing Boat Section, and secretary of the forum. But Prof. Inui has been studying the exact relation of waves to the bow and has developed and proved one type of bulbous bow to completely eliminate the bow wave. It has already proved practical for a passenger vessel, Mr. Traung said, pointing to an aerial photo of two identical ships moving along at full speed. One ship had only a thin spume of white tailing from its stern and no bow wave due to its Inui bulb bow. And now Mr. Inui is trying to adapt his discovery to other vessels. The advantages of a waveless ship? Using 1,000 h.p. where you would use 1,500 h.p. — much less pitch and much more space.

The problems of taking radioactive samples at sea is a fascinating subject, Mr. Traung, and they were presented by oceanographers from the Scripps Institute of Oceanography, La Jolla, Calif., who have been involved in trying to develop a vessel for this purpose. The possibility of using catamarans, the twin hull ships, as research vessels was representatives of the University of Miami, Fla. The university has been considering using an ocean-going catamaran for fisheries research and already has a small one in operation. Purported to be cheaper to operate due to less wave resistance, the catamaran has the practical advantage of providing more working space on the

large platform that joins its twin halls together. However, one of the greatest factors to be considered in designing a new research vessel is not only cost of construction, but the cost of operation and maintenance. The new ship must be tailored to its job. - Such a tailoring job was reported on at the forum by Dr. H.F.P. Herdman of the National Institute of Oceanography, Wormsley, England, who is supervising the building of a new ship to replace the *Discovery II*, the latest in a series of pioneer British fishery research ships. The boat, now under construction in Aberdeen, Scotland, will incorporate all the new features learned from patient experiments with its parent craft. This will include such items as a bow propeller to increase manoeuvrability when retrieving modern oceanographic or biological apparatus moored in the open sea. Lately, research vessels have a new function: doing research and providing general knowledge on ship behaviour that the naval architect can utilize in ship design. Papers were given on how these research vessels may give naval architects insight into ship behaviour—insight that can be directly used when designing passenger ships and super tankers. The forum spent its first two days discussing work that is done on board a research vessel. The participants then boarded the 1,215 ton research vessel, the *KOYO MARU* of the Shimonoseki College of Fisheries, for a two day practical demonstration and then resume the meeting ashore.

FAO Expert Meeting On Economic Effects Of Fishery Regulations

A need to supply more relevant facts about conditions in specific fisheries, in order to aid administrators in developing fishery regulations, was voiced by an FAO

fisheries officer in summing up the FAO Expert Meeting on Economic Effects of fishery Regulations, held in Ottawa June 12-17.

Biologists, economists and other specialists in fisheries still need to combine in assembling the data required by policy-makers, said the Chief, Biology Branch, FAO Fisheries Division. Experts in different disciplines must be encouraged to acquire a knowledge of each other's techniques to blend their efforts. A mere addition to research results of projects pursued along separate lines will not suffice. But a good start has been made at this meeting in approaching the problems of managing fisheries along national lines by bringing specialists together from different fields.

The purpose of the meeting was to add to the theoretical knowledge of the economic management of fisheries. Until recently, regulating fishery resources was a means of protecting these resources and maintaining a steady yield. However, a rate of fishing that produced maximum steady yield might not necessarily be the most economical one.

The meeting, attended by 70 representatives from 20 countries and international fishery commissions, was chaired by Mr. George R. Clark, Deputy Minister of Fisheries of Canada. Speaking at the opening session were the Canadian Fisheries Minister, Mr. J. Angus MacLean and Mr. H.A. Vogel, FAO North American Regional Representative. Other experts representing the views of economists and administrators participating in the meeting were Prof. J.A. Crutchfield, Associate Professor, University of Washington Department of Economics, and Dr. A.L. Pritchard, Director, Conservation and Development Service, Canadian Department of Fisheries.

Professor Crutchfield supported the demand for additional case studies of specific fisheries and pointed out that the experience gained could be of great potential use in providing technical assistance to developing countries. Fishery regulations in developed countries have been instituted for the most part only after unsatisfactory conditions in already-exploited fisheries had arisen. The knowledge acquired in the study of these situations could be profitably applied in designing sound control programs for as-yet-unexploited fisheries.

Dr. Pritchard said that the one sector which had not been represented at this meeting was policy-making. Legislators, my experience has taught me, will respond to reasonable persuasion. It is the duty of administrators and technical experts, therefore, to provide them with the evidence they needed for policy decisions. The educational process had to go even farther, he said, for there was a responsibility on the part of the experts, to get the facts to the public. The industry and the public generally had to know why control measures were put into practice, including the economic reasoning behind the advocacy of certain types of regulations.

African and European Fish Commissions

The new fishery commissions, one for Europe and the other for Western Africa, won approval from the FAO Council at a meeting at Rome in its 35th session. The 25-nation Council met to review proposals for FAO's activities and budget for 1962/63 and to develop a provisional agenda and outline of work for

the full 88-member Conference's session in November 1961. The European Inland Fisheries Advisory Commission (EIFAC) which held its initial session in Dublin in April 1960, had its rules of procedure confirmed by the Council. The establishment of such a commission was approved by the Council in 1959. The Council also approved in principle the establishment of a Regional Fisheries Commission for Western Africa. A text concerning the proposed Commission's terms of reference and procedures will be prepared for approval by the Council when it meets again prior to the FAO Conference here in November.

The EIFAC had five basic points for its first working platform. They were mutual aid; fish-pond culture; a survey of lakes and streams; pollution control and fish diseases; and a review of the principal species of European fish. Its member nations are; Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Israel, Italy, the Netherlands, Portugal, Turkey, the United Kingdom and Yugoslavia.

The African commission will be concerned with the region extending from Cape Spartel to the Cape of Good Hope and would serve that area in a manner similar to other FAO fisheries bodies in the Mediterranean and Indo-Pacific regions. The proposal for a new fisheries consultative body for Western Africa is the result of an FAO-sponsored meeting held at Dakar in May 1961, where delegations from eight nations met to consider establishing a body in the western part of Africa to serve that area in a manner similar to other FAO fisheries bodies in

the Mediterranean and Indo-Pacific regions. The proposed commission would include FAO member countries between Cape Spartel and the Cape of Good Hope, whose territories lie wholly or partially within regions which drain into the Atlantic Ocean and Lake Chad. Establishment of the commission was proposed unanimously by the delegates representing Ghana, Guinea, the Ivory Coast, Liberia, Nigerai, Portugal, Senegal and Spain; the proposal was supported also by Sierra Leone and Togo. Representatives from France, the Islamic Republic of Mauritania, the United States of America and the Commission for Technical Co-operation in Africa south of the Sahara attended as observers, and spoke in support of this proposal. The Dakar meeting named Dr. Samba Cor Sar, of the Republic of Senegal, chairman, and Mr. Eric A. Kwei, Republic of Ghana, vice-chairman. Representing FAO were Mr. Pierre Terver, FAO Regional Representative for Africa, Dr. D.B. Finn, Director, FAO Fisheries Division and Dr. Arno W. Meschkat, FAO Regional Fisheries Officer for Africa. The delegates were unanimous in agreeing that such a

regional fisheries body was necessary. They felt that problems not only of oceanography and marine biology, but also concerning the inland waters, must be considered as a whole from the geographical point of view, disregarding political frontiers. This would apply to coastal fisheries much as sardinella to fishing on the high seas, and also to the fisheries of the great river basins. The countries agreed that the technical problems arising from fishing, such as catching, processing, storing and distribution, were common to them all. As their geographical, climatic and socio-economic conditions were similar, a great advantage could be gained through mutual experience and effort. Furthermore, the need for closer economic collaboration, under the auspices of a consultative body, among countries concerned with the increasing inter-regional trade in fish and the growing export trade, was pointed out at the Dakar meeting. Suggestions were made on the possibility of education and vocational training of fishermen plus the training of instructors in fishing techniques, within the framework of a new fisheries consultative body.

FORTHCOMING FAO MEETINGS AND TRAINING CENTERS, 1962

MEETINGS 1961

Date	Subject	Convening Body and/or Organizers	Location
5-12 Dec.	5th Joint FAO/WHO Nutrition Conference for Far East	Nutrition Division FAO	Hyderabad, India
18-21 Dec.	Consultant's Meeting on Marine Bio-Geography	Fisheries Division FAO	Rome

MEETINGS 1962

June	FAO/WHO/UNICEF Protein Advisory Group	Nutrition Division FAO	New York
2-14 July	World Scientific Meeting on the Biology of Tunas and Related Species	Fisheries Division FAO	La Jolla, Calif.
Undet	FAO Meeting with Food Industries and UNICEF on Protein-rich Foods	Nutrition Division FAO	Rome
October	Indo-Pacific Fisheries Council-10th Session	Secretariat, IPFC, Bangkok	Seoul, Korea

IMPORTANT IPFC PUBLICATIONS

PROCEEDINGS (Records of Council Sessions.)

*First Meeting, Singapore, 24 - 31 March 1949

Section I :	Report of Proceedings
Section II :	Working Papers
Section III :	Contributed Papers
Section IV :	Symposium Papers

Second Meeting, Cronulla, N.S.W., Australia, 17 - 22 April 1950

Section I :	Report of Proceedings
Section II :	Technical Papers
Section III :	Symposium Papers

Third Meeting, Madras, India, 1-16 February 1951

Section I :	Report of Proceedings
*Section II :	Technical Papers
*Section III :	Symposium Papers

Fourth Meeting, Quezon, Philippines, 23 October - 7 November 1952

Section I :	Report of Proceedings
*Section II :	Technical Papers and Symposium Papers

Fifth Meeting, Bangkok, Thailand, 22 January - 5 February 1954

Section I :	Report of Proceedings
*Section II :	Technical Papers
Section III :	Symposium Papers

Sixth Session, Tokyo, Japan, 30 September - 14 October 1955

Section I :	Report of Proceedings
Section II :	Technical Papers
Section III :	Symposium Papers

Seventh Session, Bandung, Indonesia, 13 - 27 May 1957

Section I :	Report of Proceedings
Section II :	Technical Papers
Section III :	Symposium Papers

Eighth Session, Colombo, Ceylon, 6 - 22 December 1958

Section I :	Report of Proceedings
Section II :	Technical Papers
Section III :	Symposium Papers

Ninth Session, Karachi, Pakistan, 6 - 23 January 1961

Section I :	Report of Proceedings (in Press)
Section II :	Technical Papers (under preparation)
Section III :	Symposium Papers (under preparation)

(* Items so marked are out of print.)

CURRENT AFFAIRS BULLETIN

No. 1-32 July 1951 - December 1961 (*1-21, 23)

SPECIAL PUBLICATIONS (Irregular)

- * No. 1: Schuster, W.H. (1952). Fish Culture in Brackish-water Ponds of Jawa. 1 - 143 pp.
- * No. 2: Anonymous, (1952). Fish Culture in Indonesia. 1 - 126 pp.
- No. 3: Zaneveld, J.S. (1955). Economic Marine Algae of Tropical South and East Asia and their Utilization. 1 - 55 pp.
- No. 4: Anonymous, (1958). Annotated Bibliography on Fishing Gear and Methods.

MISCELLANEOUS

Directory of Fisheries Institutions-Asia and the Far East.

1961 OCCASIONAL PAPERS

- No. 61/1 The Rastrelliger Fishery Research in Thailand, by S. Bandhukul.
- No. 61/2 A Preliminary Bibliography of the Freshwater Algae of the Indo-Malaysian Region, by G.A. Prowse
- No. 61/3 Some Aspects of Prawn Drying in Kerala, by S.N. Rao and A.G. Vasavan.
- No. 61/4 Economic Marine Algae of Ceylon, by M. Durairatnam.
- No. 61/5 A Review of the Salt Fish Industry of Kerala, by S.N. Rao and A.G. Vasavan.
- No. 61/6 An Observation on the Development of Tuna Like Fishes Trolling by Motorized Vessels, by M. Unar.
- No. 61/7 Plankton Studies in Manila Bay, by I.A. Ronquillo and E. Bernabe.
- No. 61/8 Status and Progress of Chanos Fishery in the Philippines, by H.R. Rabanal.
- No. 61/9 Present Status of Research and Development in connection with the Chanos Fisheries in Vietnam, by Le Van Dang.
- No. 61/10 Fisheries Statistics of Thailand, by S. Suwananonta.
- No. 61/11 A Preliminary List of Inshore Diatoms of the Southern Coast of Korea, by Dwan Yong Cho and Won Tack Yang.
- No. 61/12 Report of a Preliminary Survey of the Ajamaroe Lakes, Netherlands New Guinea, by G.A. Reeskamp.
- No. 61/13 Research Activities on Marine and Freshwater Agriculture and Propagation, Central Fisheries Experimental Station, Pusan.
- No. 61/14 Artificial Drying of Cambodian Fish, by R. Legendre.

(* Items so marked are out of print.)

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